# AN ANALYSIS OF CONTEMPORARY THEORIES OF LEARNING WITH A VIEW TOWARD THEIR APPLICABILITY IN CLASSROOM TEACHING SITUATIONS

by

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# CHAPTER I

## INTRODUCTION

### A. Statement of the Problem.

It has become increasingly evident to many of the modern leaders in the field of teaching that an adequate theory of learning is one of the basic requirements for attainment of professional competence. It is equally evident from certain contemporary textbooks in methodology that considerable confusion exists as to what should be accepted as an adequate theory of learning. As an example, in a comparatively recent publication (1941) on "Principles and Practices of Teaching in Secondary Schools," Thomas M. Risk writes:

> ....students should know that psychologists do not agree among themselves regarding the laws of learning,...Various other laws of learning, proposed by Thorndike and others, are sometimes treated under separate names... the use of which often confuses the beginning student because of the multiplicity of names and interpretations.
>
> As pointed out, some psychologists have severely criticized Thorndike's laws; some go so far as to say that they explain nothing and are therefore useless. All this is highly confusing, and it makes many feel that any attempt to apply the psychology of learning to teaching is futile....The important thing in teaching is to observe <u>what activities or experiences are effective in learning under different conditions</u>.[1]

1. Italics are in the original quotation. (Hereafter underlined portions of quotations will represent italics in the original, unless otherwise stated.)

> Such objective evidence will help the teacher to choose wisely the learning exercises or activities in some future learning situation....[2].

> Owing to the different theoretical explanations of learning, many terms are necessary to express various shades of meaning, and some of the terms are interpreted differently by different authorities.... Such differences are apt to be confusing unless the student has time to make an extended study of each theory.[3].

That such confusion exists is evident in other writings although few are as free to admit it as is Risk. Such a situation poses a serious problem. Are the data which come from research and thinking on this problem so contradictory that harmonious conclusions are impossible? If an adequate theory of learning is as difficult for a novice to secure as Risk suggests, then, until this difficulty is overcome there is no real chance to raise the level of teacher competence. Risk's proposal, implied in the quotation, that teachers rely entirely upon classroom observations to supply them with the necessary data for formulating their practical theory of learning, is highly questionable. It would be almost certain to increase the confusion rather than reduce it. William H. Burton points out the danger for teachers of relying upon methods based on "experience." His comments are as follows:

2. Thomas M. Risk, Principles and Practices of Teaching in Secondary Schools, p. 59.
3. Ibid, p. 76.

> Uncritical experience in teaching is almost more detrimental than beneficial. Literally thousands of teachers are, by their own experience, actually prevented from learning how to teach well! They are prevented even from discovering that they are doing poor teaching. Unaccompanied by the critical analysis and study of researches, teaching experience is likely to be distinctly detrimental. Twenty years of experience in teaching is too often twenty years of experiencing the wrong way to teach the wrong things. Evidence is emerging which seems to indicate that theory is far more rampant among so-called practical teachers than anywhere else. Many older teachers persist in going through teaching motions which have a purely capricious basis and which cannot achieve reputable learning. Teachers who rather agressively rely upon "their experience" and reject "theoretical" methods seem to condemn as theoretical, methods (a) which they do not understand, (b) which they are unable to operate successfully, and (c) which necessitate the abandonment of long-used routines.[4]

Other present-day writers believe that controversies regarding theories of learning are the result of an exaggerated emphasis upon some minor or unimportant phase of a particular system of thought. They maintain that for practical classroom purposes the essentials of these various theories can be harmonized successfully. Most noteworthy of these attempts is, without doubt, the work of the National Society for the Study of Education. Publication of their 41st Yearbook in 1942 presented the results of this effort. (Part II: The Psychology of Learning.)

4. William H. Burton, The Guidance of Learning Activities, p. 79.

Serving as chairman of the committee for this study, T. R. McConnell wrote the chapter which summarizes the results. His position represents an attempt to effect reconciliation of the various theories of learning. His ideas are presented again in a textbook on Educational Psychology, published in 1942. Four authors collaborated in writing this text, with McConnell submitting the section on various aspects of learning.

Since an adequate theory of learning is considered by many careful thinkers to be essential for attainment of professional competence, a study of available data relevant to the development of a theory of learning has particular significance in the field of education. Contemporary texts which propose reconciliation among the conflicting points of view with respect to learning along with contemporary texts in methodology should provide a readily accessible source of such data. It will be the purpose of this study to investigate the present status of theories of learning as presented in certain current professional textbooks; to determine to what extent and in what manner reconciliation among the conflicting points of view has been effected; to determine whether these proposals eliminate the conflicts which exist; and, to determine which proposal appears to fit available data best.

B. Criteria for Evaulation.

The criteria for the evaluation undertaken in this study are two-fold, namely, the criterion of adequacy and the criterion of consistency. A theory of learning is considered adequate if it takes cognizance of all relevant data which are available. A theory of learning is considered consistent if it agrees with available data and if interpretations of such data are in self-agreement. These criteria are suggested by Ernest E. Bayles in an article specifically related to teaching problems. He writes,

> The criteria of enhancement (coverage) and harmonization (internal consistency) apply to solutions for individual problems as well as to an entire outlook on life. In subjecting each solution to the two tests, (a) "Does it take into account all pertinent and available data?" and (b) "Is it consistent not only with such data but also with other solutions accepted by the pupil?", we promote a pupil's ability to solve individual problems as they arise and at the same time we promote the enhancement and harmonization of his entire outlook on life.[5]

C. Basic Conflicting Views of Ultimate Reality.

In order to understand clearly the issues involved in a study of conflicting theories of learning, it is necessary to consider at length the broader conflict between

5. Ernest E. Bayles, "The Relativity Principle as Applied to Teaching," University of Kansas, Bulletin of Education, p. 7.

two distinct points of view. From the beginning of civilization man has attempted to establish a working relationship with all phases of his environment. He has attempted to deal successfully with events and with the animate and inanimate objects in his surroundings. Aspects of man's environment which appear to be stable and unchanging are considered by man to be relatively easy to handle. Aspects which have given man most trouble in his efforts to get along are those that constantly change, the unpredictable phenomena.

It is perhaps natural then that fixedness, or unchangingness, should, in the early thinking of man, acquire an attribute of virtue and that changeableness should be considered evil. At any rate, early in the course of civilization man began to search for the unchanging, the fixed things in his environment, in the hope that such knowledge would enable him to deal better with perplexing problems. An assumption implied in this search, tacitly accepted if not openly stated, is that there does exist a pre-established unity and order; that there are fixed entities, absolutes. This is the assumption common to thinking which has been termed absolutistic. Under this assumption man worked for a considerable period of time at the problem of harmonizing the conflicting elements of his environment.

From time to time certain people have thought that perhaps such an absolutistic assumption was inadvisable under existing conditions. These people have suggested that man might proceed under an opposite assumption, namely, that everything is in a continual state of flux, that everything at all times is changing. This assumption is essential to thinking which has been termed relativistic. Concerted study of this latter point of view and its application to many fields of human endeavor have occurred within the past century.

One reason for the comparatively recent emergence of this point of view is that during the past century much of the structure of apparent absolutes, which man had built up over a period of centuries, has been destroyed. Scientifically established data have shown that the fixed quality of these apparent absolutes is not as fixed as had been assumed. For example, Newton's law of gravitation has been shown to be inadequate; it has been shown that Euclid's postulates, upon which he based his geometry, are not necessarily true; or, in psychology, the concept of instincts, which were assumed to be fixed for each species of animal life, has been shown to be unwarranted. This collapse of apparent absolutes has shown more conclusively than ever that the most important problem which man has to face is that of establishing a working relationship with the continually changing features of his environment.

Thus the relativistic view faces a most troublesome problem squarely. A relativist believes that man's efforts to cope successfully with the changing aspects of his environment will be more productive if he discontinues his search for fixed entities. The working relationships among apparent realities, whether objects, events, or ideas, become more important than the nature of ultimate substance of these apparent realities.

These two basic and opposite assumptions have developed as man has endeavored to find ways and means of getting along with the world in which he lives. The choices which individual persons have made with regard to assumptions of ultimate reality have determined the broad outline of their courses of action. If one assumes the existence of a pre-established unity, if one assumes an ultimate reality, he will direct his activity toward gaining possession of the knowledge of this reality. If one assumes that there are no absolutes, he will be more likely to direct his activity toward devising means for dealing effectively with the constantly changing phases of his environment. A philosophy of fixed ends concentrates attention upon the fixation of knowledge rather than upon the process of acquiring it.

The influence of these two conceptions can be traced in every realm of human thought and endeavor, and the ramifications are extremely varied. In the field of

physics the work of Newton represents application of an absolutistic pattern of thought. Time and space are for Newton fixed and separate properties of the physical world. A translation of his "Principia Mathematica" illustrates this point:

> I. Absolute, true, and mathematical time, of itself, and from its own nature flows equably without regard to anything external, and by another name is called duration; relative, apparent, and common time is some sensible and external (whether accurate or equable) measure of duration by means of motion which is commonly used instead of true time, such as an hour, a day, a month, a year.
>
> II. Absolute space, in its own nature, without regard to anything external, remains always similar and immoveable.
>
> III. Place is a part of space which a body takes up, and is according to the space, either absolute or relative.
>
> IV. Absolute motion is the translation of a body from one absolute place into another; and relative motion, the translation from one relative place into another.[6]

Contrasted with the work of Newton is that of such men as Einstein who attempt to apply relativistic principles to physics. There are no assumptions of static reference points such as absolute space or time in Einstein's theory. Emile Borel characterizes it thus,

6. Sir Isaac Newton, Mathematical Principles, pp.6-7 (Translated by Andrew Motte, 1729.)

> The essence of Einstein's hypothesis, which is known as the special theory of relativity, consists in the postulate or axiom that there is no reason whatever for assuming a priori that space and time can be defined independently of one another, that is to say independently of motion. In other words, given two physical phenomena, such as two gaseous explosions, one on the sun and the other upon the earth, there is no sense a priori in saying that these phenomena are simultaneous, since simultaneity cannot be defined unless some physical means be given by which it can be tested experimentally.[7]

Mass and motion are fixed properties of the elements, according to Newton. Mass and motion for Einstein are not considered fixed, but are taken to be dependent upon the relationship of an element to its surroundings. Similar contrasts could be pointed out, as in the field of mathematics, between Euclidean geometry, based upon axioms which were assumed to be self-evident truths regarding space relationships, and the geometries of Riemann or Lobatschewski which are based upon assumptions different from those used by Euclid.

This comparison does not imply an evaluation by the writer of the results which followed from these distinct ways of regarding reality. In each case, application of the principles of relativity follow the work which had been done under the influence of absolutistic concepts. Prior to the time that relativity theory began to make an

7. Emile Borel, Space and Time, pp. 154-155.

impression upon thinking in these various fields, forward progress of research had appeared to be approaching a point of stagnation. It appeared to some that perhaps the laws of the universe had been discovered at last; perhaps ultimate truth had been found. However, the application of relativity principles revitalized work in many fields and made new discoveries possible. Hartmann stresses the importance of this new view in his statement, "The greatest intellectual achievement of the twentieth century appears to be the development and demonstration of the principle of relativity in the cosmos,[8]. ..."

It should be pointed out further that there is no common ground on which these two ways of regarding reality can be successfully compromised. By the very nature of the assumptions an either-or choice is required. One can not be consistently relativistic if he assumes the existence of any absolute reality which may or may not be regarded as knowable. One can not be consistently absolutistic if he assumes that there are realms which are not governed, ultimately, by absolutistic laws. It is true that in ordinary living one may act as if in one situation there were no absolutes and in others there were. In the

8. George W. Hartman, "The Field Theory of Learning and Its Educational Consequences," 41st Yearbook, National Society for the Study of Education, p. 170.

field of teaching, for example, one can teach in the social sciences as if rules for society are relative to a particular cultural standard of a given social group and at the same time teach in physics as if laws of this science are fixed and unchanging. Or one can teach in the social sciences as if rules for conduct are fixed and at the same time teach in physics as if the laws are continually changing. Such teachers may never be aware of the basic conflict between the implications of these two ways of teaching. However, the existence of such conflict can be readily ascertained if one takes the time to determine the basic assumption regarding ultimate reality which is required by each way of teaching.

D. Absolutism and Relativism in Philosophy.

In view of the close historical connection between philosophy and psychology, it is necessary in a systematic study of psychology to point out the main contrasts which these two ways of thinking have produced in philosophy. Absolutistic thinking has been responsible for two main trends, both of which can be abstracted for purposes of broad classification and identification. The belief that ultimate reality is to be found in a concept or idea, Idealism, is one of these main trends. It is unlikely that the writing or thoughts of any individual would fit perfectly this basic characterization but a few examples will be given to illustrate.

An Idealist believes that ideas have a quality of perfection which is never present in the material world. The application of this concept to the ideas of "goodness" and "badness" is illustrated in the following quotation:

> The goods and evils of our earthly life are purely relative to each other and to human conditions. They are even interchangeable. Goodness may be sought for, now in this set of actions, now in that. It may be attached to things once accounted evil. Evil may be attached to things once accounted good. Goodness itself remains as an eternal and immutable Idea.
>
> Badness also remains as an eternal and immutable Idea. So that we do not seem to have gained much. But we have gained this, that we are not <u>compelled</u> to attribute reality to badness. It also is, for us, the mysterious and harmless logical function by which its appearances are recognized and known. What it may be in itself, or "in the Absolute," the finite selves do not know.
>
> They only know (and this is our immense gain) that in themselves, or in the Absolute, Goodness and Badness are no longer relative to each other.[9]

Not only is absolute permanence, and therefore ultimate reality, ascribed to ideas, but it is ascribed also to mind, as Edgar Brightman indicates,

> One of the chief differences between mind and physical objects as they are ordinarily understood is its immediacy. When we speak of the immediacy of the mind, we mean the fact that it is actually present. We do not have to guess or hope or infer that we are conscious, or that our experience exists. Consciousness is given as an inescapable fact. But the objects of physics

9. May Sinclair, <u>A Defense of Idealism</u>, p. 304.

> and chemistry do not appear to be immediate or given in the same sense as mind is given and immediate. Certain perceptions occur in my mind; I interpret them and infer the existence of molecules and electrons. ..... Observation and knowledge are acts of mind; but the thing observed or known may be an entity which never has been and never will be a part of my mind.
>
> We may even go farther and say that not only is mind immediate, but also nothing but mind is immediate. All that ever can be immediately present is mind.[10]

If mind is taken as the only thing that is actually present and the possibility of the existence of anything else is by inference only, then the realm of ultimate reality is mind. This assumption can be found in the writings of older philosophers such as St. Augustine, Thomas Aquinas, Bishop Berkeley, or of present day writers such as W. E. Hocking. The fact that physical objects change is accepted as self evident. The assumption of the existence of ultimate reality in some form makes it necessary to consider idea or mind as something unchanging and eternal.

The divergence between these beliefs and those common to the second trend which absolutistic thinking has taken is found in the sharp distinction which is set up between the mental phenomena (mind) and material, physical objects (matter). This division is made quite clear by Horne, contending for the Idealistic point of view, when he writes,

10. Edgar S. Brightman, A Philosophy of Ideals, p. 13.

> Matter occupies space, mind does not occupy space. Space itself as we conceive it is an idea in our own mind. Whatever else space is, in addition to an idea in our own mind, may (reasoning by analogy) very well be an idea in the universal mind. Matter has weight, but the mind has no weight.... But all these dimensional qualities are, as we conceive them, ideas in our own minds; ....
>
> The mind that thinks matter cannot itself be matter, and matter, being unintelligent, cannot think itself.[11]

Some philosophers, who do not accept the assumption of ultimate reality as found in mind, propose instead that ultimate reality may be found in matter. These, the Realists, have frequently been in direct and bitter conflict with proponents of the former point of view. The Realists were dissatisfied with the lack of objectivity which was apparent in the realities proposed by Idealists. Realists reason that since activities of mind are beyond common observation scientific procedures cannot be applied. Nor can the truth or falsity of an absolute idea be subjected to scientific experimentation and verification. Physical objects, matter, on the other hand, can be weighed, measured, analyzed and thoroughly investigated. Different observers can subject matter to controlled scientific research and all will presumably arrive at the same conclusions. All of this lent credence to the assumption of the existence of ultimate reality in matter.

11. Herman H. Horne, "An Idealistic Philosophy of Education," 41st Yearbook, National Society for the Study of Education, p. 142.

A strict Realist believes that the essence of reality is to be found in the physical object and that the idea which we have regarding that essence is an imperfect copy. Breed, a contemporary Realist, states the position in this way:

> In comparison with the instrumentalist, the realist is generally regarded as a somewhat more conservative individual, and probably is. He is somewhat more conservative because he has more respect than the instrumentalist for the truths of science. He has this greater measure of respect because he believes the laws of science rest on something much more stable than the facts of human behavior. Human behavior is a factor in their discovery, but, to him, an idea or a plan of action achieves the stamp of truth the way a penny wins in a matching game -- by conformity with something external to itself and not of its own creation. To every idea nature seems to say in effect, "You're matching me." The laws of the physical world thus become more than mere assertions regarding the qualities and interrelations of thought creations. They are statements, including mathematical formulas, reflecting the nature and interrelations of independent existents -a vast concourse of entities with which our personal entities must live, and about which they must know if they would live effectively.[12]

Breed, in this statement, suggests that idea should be brought into conformity with reality which exists independent of idea. In the following statement the same basic assumptions are evident when a distinction is made between the knower and the thing known.

12. Fredrick S. Breed, "Education and the Realistic Outlook," 41st Yearbook, N.S.S.E., p. 101.

> When knowledge takes place there is a knower interacting with things.... The difference between knower and known is like the difference between bodies, or states of consciousness, or societies, or colors, or any grouping of things whatsoever in the respect that they must be brought into one field of study, and observed in their mutual transactions.
>
> In all this it is presupposed that if there is to be knowledge, there must be something there to be known, and something there to know; 'there' meaning the field in which their relation obtains.... The realist believes that he thus discovers that the interrelation in question is not responsible for the character of the thing known. In the first place being known is something that <u>happens</u> to a pre-existing thing. The characters of that preexisting thing determine what happens when it is known.[13].

The assumption of the pre-existence of matter includes, for a consistent Realist, the denial of reality in any other form. This is the position taken by Hugh Elliot as indicated in the following:

> The main principles which I shall endeavor to emphasize are three.
> 1. The uniformity of law....
> 2. The denial of teleology..
> 3. The denial of any form of existence other than those envisaged by physics and chemistry, that is to say, other than existences that have some kind of palpable material characteristics and qualities.[14].

The assumption that ultimate reality is to be found only in matter includes the implication that the universe can be

13. Edwin B. Holt, et al, <u>The New Realism</u>, p. 34
14. Hugh Elliot, <u>Modern Science and Materialism</u>, p. 138, ff.

understood by observing and discovering the essences or elements out of which it is made, as has been done in physics and chemistry. That is, by breaking down complex structures into irreducible elements a scientist will find the nature of ultimate reality. It implies also that an idea, by a series of successive approximations, can be brought more and more into conformity with reality. Historically, research undertaken by Realists has been primarily concerned with analysis of complex wholes into their component parts.

Since the assumptions of both Idealism and Realism are absolutistic, there is a degree of compatibility between the two positions. A dualistic point of view which posits reality in both mind and matter is advocated by some. Generally this proposal is made with the belief that these two categories are mutually independent and distinct. If independent and distinct, no conflicts need arise, it is believed. However, this assumption has invariably produced conflicts because for practical purposes phenomena of mind and phenomena of matter cannot be separated as rigorously as is necessary in order to eliminate conflict.

In contrast to the type of thinking which assumes the existence of ultimate reality in some form, the application of principles of relativity to the field of philosophy has been undertaken by such men as William James, Max C. Otto, and John Dewey. It has appeared under the names of

pragmatism, instrumentalism, and operationism. A relativistic treatment of absolutes is illustrated by Bridgman:

> Relativity in the general sense is the merest truism if the operational definition of concept is accepted, for experience is described in terms of concepts, and since our concepts are constructed of operations, all our knowledge must unescapably be relative to the operations selected.[15] But knowledge is also relative in a narrower sense, as when we say that there is no such thing as absolute rest (or motion) or absolute size, but rest and size are relative terms...
> The "absolute" therefore disappears in the original meaning of the word.[16]

This relational emphasis of the relativistic view has important implications for philosophy. A relativist refuses to look for a perfect pattern in either idea or matter. A relativist recognizes a form of reality in both things and ideas but does not search for ultimate reality in either. This attitude is expressed by Max C. Otto in the preface to his book, "Things and Ideals." He writes,

> The twelve essays in this book are devoted to a cause. They are intended to help make articulate a social philosophy which recognizes equally the reality of things and ideals, and which aims to further their reciprocal interpenetration in the interests of human happiness.....
> People who insist upon being freed from the tryanny of "the many that change and pass," who absolutely refuse to seek

15. Italics not in the original.
16. P. W. Bridgman, The Logic of Modern Physics, pp. 25-26.

> in the world of change for the means of its redemption, as well as those who are set in their denial of the reality or efficacy of anything but things, will do well to save themselves the irritation of reading the pages that follow.[17].

In his discussion of the possibility of "rapprochement" between science and religion, he emphasizes the relational aspect of both things and ideals. He believes that reduction of conflict between science and religion depends upon two factors. First, "The recognition that scientific concepts and generalizations are not literal transcripts of reality but highly selective constructs of the human mind; not discoveries in the strict sense, but inventions, products of the creative imagination of men of genius."[18]. And, second, that ideals should not be identified with a "mystical abstraction" but rather with "active concern for the most liveable, joyous, common life; with dedication to the human venture."[19].

An absolutist works on the assumption that realities in nature are irreducible, indivisible elements and that any complex object or mental event is a combination or integration of these elements. A relativist begins with constantly changing systems or fields and describes the parts or the single event in terms of the whole system or

17. Max C. Otto, Things and Ideals, p. v
18. Ibid, p. 214.
19. Ibid, p. 222.

field. He believes that in order to be comprehended all phenomena must be considered as occurring within some field, the organization of which will explain the meaning of the localized event. With regard, for example, to a physical object, the apparently inherent, absolute properties are a function of the apparent organization and structure of the field in which the object is located. Hartmann[20] gives an illustration of this in the perceptual field. He points out that the character "1" on the typewriter has the same physically isolatable form when it appears in a number combination such as "1947" and in the letter combination of the word "love," in that the same key is used for both. But the structure of the field gives two distinct meanings to the identical symbol.

This simple illustration indicates that a relational interpretation is effectual in giving meaning to the symbol "1" whereas supposed knowledge of absolute properties is not. Successful use of the symbol depends upon recognizing the relationships which it assumes in different perceptual fields rather than upon analysis of the supposedly unchanging properties of the symbol.

20. George W. Hartmann, "The Field Theory of Learning and Its Educational Consequences," 41st Yearbook, N.S.S.E., p. 169, Part II

A relativist concentrates upon the problem of establishing a working relationship among the objects, events, and ideas which make up environment. The effect which this new attitude has had upon human endeavor has been expressed for philosophy by John Dewey as follows,

> .....Instead of the disputes of rivals about the nature of reality, we have the scene of human clash of social purpose and aspirations. ....Instead of impersonal and purely speculative endeavors to contemplate as remote beholders the nature of absolute things-in-themselves, we have a living picture of the choice of thoughtful men about what they would have life to be and to what ends they would have men shape their intelligent activities.
> .....Philosophy which surrenders its somewhat barren monopoly of dealings with Ultimate and Absolute Reality will find a compensation in enlightening the moral forces which move mankind and in contributing to the aspirations of men to attain to a more ordered and intelligent happiness.[21]

The foregoing summary is presented to illustrate the three main ways of viewing the possibility of existence of ultimate reality as they have developed in the field of philosophy. With respect to the assumption that pre-established entities do exist, Idealists and Realists are both opposed to a relativistic view. With respect to the assumption that ultimate reality may be found in the realm of matter, Idealism and a relativistic view are both opposed to Realism. With respect to the assumption

21. John Dewey, Reconstruction in Philosophy, pp. 25-27.

that ultimate reality may be found in the realm of mind, Realism and a relativistic view are both opposed to Idealism. An assumption of relativity as applied to philosophy does not deny the existence of reality in either matter or idea. A relativist recognizes a reality of both substance and idea. He attempts to deal with each in accordance with what it appears to be. He believes, further, that man's knowledge of possible ultimate reality has not yet achieved perfection in any realm even though man has been working for many centuries with such an end in view. The relativistic assumption in modern form is comparatively recent and much of present-day controversy in various fields of human thought can be traced to the fundamental difference between this assumption and some form of absolutism. The relation of these points of view to the field of psychology will be discussed in the next chapter.

# CHAPTER II

## CONFLICTING POINTS OF VIEW IN PSYCHOLOGY

The earlier conflicts in psychology stemmed largely from the position which psychologists took with regard to the assumption of ultimate reality in mind or matter. The relation of these conflicts to the basic pattern of philosophical thought has been presented at length by Boyd H. Bode in two books, "Conflicting Psychologies of Learning" and "How We Learn." The emphasis in the present discussion will be to indicate briefly how the fundamental ramifications affected the development of important theories of learning and to contrast at greater length the more recent conflicts which have stemmed from opposition between relativistic and absolutistic emphases.

### A. Absolutism in Faculty Psychology.

If mind is taken as the realm of ultimate reality, then the most important aspect of psychology is the growth and activity of the mind. The data of psychology become the activities which constitute mental or psychic events. The system of thought known as faculty psychology assumes that mind is endowed with an inherited set of latent powers or capacities. These are called faculties. In a late nineteenth century textbook we find the following description:

> A Mental Faculty is the mind's power of doing something or of putting forth some mental activity. The mind has as many faculties as there are distinct forms of this mental activity. Metaphysicians do not agree upon the exact number of mental faculties, some holding that attention and consciousness are distinct mental powers, while others maintain that these are only conditions which accompany all forms of mental activity.
>
> The Intellect includes a number of faculties -- Perception, Memory, Imagination, Understanding, and Reason or Intuition.[1]

Development of these faculties is considered possible by direct exercise in much the same way that physical exercise develops the body organs. This analogy, in fact, is used frequently by writers who support this view. Wickersham describes the power of exercise as follows:

> No means are known whereby the faculties of the mind can be developed but by exercising them. By the potent spell of the magic word Exercise, is evoked all human power.
>
> The proof of this proposition is found in multitudes of facts. The senses grow more acute by using them. The memory is improved by remembering, the reason by reasoning, the imagination by imagining. All these powers, too, become weak if not used. These facts may be learned from each person's own experience, or from observation upon others. The law inferred from them is fixed and universal.[2]

The implication in the above quotation that each faculty can be developed only by one special type of

1. Albert N. Raub, Methods of Teaching, p. 18.
2. James P. Wickersham, Methods of Instruction, p. 38.

exercise is stated explicitly in Wickersham's subsequent discussion. He writes,

> It is acknowledged that the body may be made strong without giving strength to the mind, that our intellectual, emotional, and executive faculties can, as classes, receive an independent culture. This law holds good of the distinctive faculties that make up the human intellect. It requires one mode of culture to educate the senses and the perceptive powers, another to strengthen the memory, and still others to develop the powers of recollection, imagination, comparison, and reason. Each intellectual power differs from the others in its nature, in its mode of operation, and modes of culture must adapt themselves to these differences.[3]

There is, however, lack of agreement among writers who support faculty psychology regarding the independent nature of these faculties. For example, Roark's textbook gives a view different from that held by Wickersham. Roark writes,

> All the faculties of the mind are inherently active and inherently useful, and their normal exercise always gives pleasure. This would be enough to justify principle II.;[4] but another reason for using it is found in the fact that, since the mind is a unit and the faculties are simply phases or manifestations of its activity, whatever strengthens one faculty indirectly strengthens all the others.

3. Ibid, pp. 38-39.
4. Principle II: All the powers of the body and all the faculties of the mind must be developed and trained to proper functioning.

> The verbal memory seems to be an exception to this statement, however, for it may be abnormally cultivated without involving, to any profitable extent, the other faculties.[5]

The important point for a theory of learning, on which faculty psychologists are agreed, is the relation of mental exercise to the development of the faculties. The theory of learning developed within this belief is that of formal discipline. The emphasis is upon exercise, the exercise of these various faculties. It makes comparatively little difference of what the material consists, just as long as it exercises the selected faculty. Thus if an individual wants to learn to remember names, he should exercise his faculty of remembering by practice on numbers, dates, or long sections of prose or poetry. If an individual wants to learn to reason he should study logic or other subjects, such as mathematics, which depend upon reasoning for their development. To quote again from Wickersham,

> Few sciences can furnish more valuable mental discipline than the Empirical sciences. They exercise the senses, the perceptive powers, the judgment, the imagination, and the reason.[6]

This conception of learning makes education a relatively simple affair. Once the desired faculties have been selected

5. Rurie N. Roark, Method in Education, p. 27
6. J. P. Wickersham, opp. cit., p. 343.

and the appropriate subject matter secured for the development of each specific faculty, the job of the teacher consists largely in seeing that a pupil carries out his assignments. The task of selecting the faculties to be developed and fitting the subject matter to them need not be done over and over again. Everyone is assumed to have been born with an identical array of faculties, each of which will respond to the same treatment regardless of the individual in whom it is to be trained.

Bode[7] shows that this close analogy between physical exercise and mental exercise implies the existence of mental substance which could benefit by the type of mental exercise described. Since the nature of these faculties is considered by faculty psychologists as entirely mental, and since these faculties constitute the entire basis for the explanation of behavior or the acquisition of knowledge, there is implied an assumption that ultimate reality is to be found within the realm of mind. Faculty psychology is, to this extent, a counterpart of the absolutistic assumptions of Idealism in philosophy.

B. Absolutism in Association Psychology.

If matter is taken as the realm of ultimate reality, then one of the most important aspects of psychology is

7. Boyd H. Bode, How We Learn, p. 88 ff.

the manner in which an idea, a concept of reality, is built up. The data of psychology, in this case, become the activities and processes by which man gains knowledge of reality. The system of psychology known as associationism seeks to explain this phenomenon. Some form of associationism can be traced as far back as Aristotle who, in order to explain the process of establishing alliances among ideas, formulated the principles of similarity and contiguity. John Locke dealt with the same problem and proposed the following answer:

> 2. All ideas come from sensation or reflection. -- Let us then suppose the mind to be, as we say, white paper, void of all characters, without any ideas; how comes it to be furnished? Whence comes it by that vast store, which the busy and boundless fancy of man has painted on it with an almost endless variety? Whence has it all the materials of reason and knowledge? To this I answer, in one word, from experience; in that all our knowledge is founded, and from that it ultimately derives itself. Our observation, employed either about external sensible objects, or about the internal operations of our minds, perceived and reflected on by ourselves, is that which supplies our understandings with all materials of thinking. These two are the fountains of knowledge, from whence all the ideas we have, or can naturally have, do spring.
> 3. The object of sensation one source of ideas. -- ... This great source of most of the ideas we have, depending wholly upon our senses, and derived by them to the understanding, I call, "Sensation."[8]

8. John Locke, Essay Concerning Human Understanding, Books I and IV, selected by May Whiton Calkins, pp. 25-26.

Locke's answer implies the assumption of the existence of reality in a world outside of the realm of mind. The basic ideas, in his concept, come from perception of sense impressions. The reflection of which he speaks depends upon the prior existence of such perception, since the mind is originally void of any ideas. The various sense organs receive impressions and transmit them to the mind. Knowledge of external realities is developed in this manner. The fact that most of what he calls experience is regarded as wholly dependent upon sensation is the significant feature of Locke's statement. The ideas are formed under these circumstances by repeated occurrence of sense impressions. If ideas are in any respect wholly dependent upon our senses, then the existence of ultimate reality within the realm of physical objects is implied; an ultimate reality, a copy of which can be automatically transmitted to the mind.

Bode discusses the fact that sense impressions by themselves cannot account for abstractions. He writes,

> In many cases, it is true, the content of our concepts seems to come directly from the outside world through sense perception. It is through sense perception that we become acquainted with qualities like hardness, fragrance, whiteness, and sweetness. As long as we limit ourselves to sense experience, however, we get only particular cases of such qualities. The fact that we

> have abstractions, e.g., whiteness which is not any particular whiteness, but whiteness as such or in general, remains to be accounted for ....[9].

He then quotes from Locke and continues his discussion by pointing out that Locke's position presupposes "an agency such as the substantive mind"[10]. in order to account for the process of developing concepts.

More exact laws of associationism were formulated shortly after the time of Locke. Hartley proposed a law which, in part, goes as follows:

> Any sensations A, B, C, etc., by being associated with one another a sufficient number of times, get such a power over the corresponding ideas a, b, c, etc., that any one of the sensations A, when impressed alone, shall be able to excite in the mind b, c, etc., the ideas of the rest.[11].

The method by which sensation A became connected with ideas b, c, etc., in sequence, was not proposed until a later date. However, the principle that association of sensations with ideas is dependent upon a "sufficient number" of repetitions of the sequence implies a neurological explanation of associationism. Such explanation was added later to this system of psychology.

9. Boyd H. Bode, op cit., pp. 31-32.
10. Ibid, p. 32.
11. David Hartley, Observations on Man, His Frame, His Duty, and His Expectations, p. 41. (Quoted by Peter Sandiford, "Connectionism: Its Origin and Main Features," 41st Yearbook, National Society for the Study of Education, p. 104. Part II)

Associationists of this early era were not much concerned with the nature of mind itself. In fact, many of them avoided the issue. Herbart says, "The simple nature of the soul is totally unknown and forever remains so; it is as little a subject for speculative as for empirical psychology."[12] The assumptions of associationists which posited reality outside of mind decreased the importance of such speculations; the assumptions of faculty psychologists require it.

The main concern of psychology as it developed under the associationists was to formulate ways and means of increasing the numerical quantity of ideas. Formulation of methods to accomplish this became primarily a matter of introspection since no individual can tell much about the mental activity of anyone other than himself.

An important theory of learning which fits into this scheme was developed largely by Herbart. He did not follow precisely the laws of association which had been proposed by his time, but believed that ideas have inherent qualities of affinity or repulsion for each other. These qualities are assumed to be independent of anything the teacher can do, and because of this learning steps can be established which will insure learning under any conditons. Herbart's five steps -- Preparation, Presentation, Comparison and Abstraction, Generalization, and Application -- are, with

12. John Adams, The Herbartian Psychology in Its Educational Applications, p. 47.

slight modifications, in use today. They are based upon his doctrine of apperception which regards learning as a process of building up and reorganizing a mass of ideas.

Tompkins gives a lesson plan which follows the general outline suggested by Herbart. Tompkins proposes the following:

> Suppose the idea pyramid is to be taught to a primary class, say a third-reader grade....
> The mind must form this new idea out of the elements of old knowledge. Let it be supposed that the knowledge most immediately connected with the new idea are the ideas solid, flat surface, straight line, triangle, and point.... the act as a whole is an act of synthesis; the pupil synthesizes the known elements into the unity of the pyramid....
> First step, leading to the generalization of the attribute solid .
> 1. Observing the manifold variety of individuals before the pupil, and those imagined by him.
> 2. Abstracting the attention from many other attributes and fixing it on the attribute, three dimensions -- solidity.
> 3. Comparing and contrasting, finding all the differences consistent with the likenesses.
> 4. Generalizing the attribute of solidity, -- "These objects are solids."[13].

He continues with four other steps, patterned after the first which deal with generalization of other attributes of a pyramid. In this way, according to this form of associationism, the pyramid idea is thought to be developed.

13. Arnold Tompkins, The Philosophy of Teaching, pp. 11-13.

The phase of associationism psychology which implies an assumption regarding the possible existence of ultimate reality is the manner in which ideas are presumed to be developed. Locke, Hartley, Herbart, and others held similar views on this issue. They regarded ideas or knowledge as that which was developed within the mind by the transmission of stimuli from receptor organs. Reality, in this scheme, must exist prior to the original idea. The idea is first a copy of reality. Each of the sense organs contributes a unique impression or reality, and an idea which has been developed through the use of all sense organs is more accurate than an idea which has been developed through the use of only one.

Hartley elaborated upon this basic assumption regarding the correspondence between idea and reality and his law of association implies that sensations (stimuli) will become directly connected with a corresponding idea. Such direct connection is necessary in order to make the law of association work. Hartley was among the first to state openly an assumption of a type of direct neural connection. Such an assumption is a natural development of thinking which seeks to establish automatic correspondence between a pre-existing reality and the idea of that reality.

An assumption of the existence of such realities is found in absolutistic thinking. An assumption that such

realities exist outside of the realm of mind, but within the realm of matter, is found in Realism. Traditional associationism represents, in its general features, an application of a Realistic philosophy to the field of psychology. The tacit assumption of ultimate reality within the realm of matter is implied in many of the statements made by psychologists of this era. Association psychology has been elaborated further and has formed the basis for some of the more modern psychological systems. Examples of the extension of these principles will be presented in the next section.

C. Extension of Realism in Later Psychologies.

The assumption that our knowledge of reality is revealed to us by our sense organs is evident in three systems of psychology which have appeared since the early development of associationism. One of these, behaviorism, seeks to explain human behavior entirely in terms of directly observable events. John B. Watson, the leading behaviorist, disliked the subjectivity of the introspective methods of associationism and sought to develop psychology purely as an objective science. He chose to disregard the existence of mental or psychic events. With respect to this he says,

> "States of consciousness" like the so-called phenomena of spiritualism are

> not objectively verifiable and for that reason can never become data for science.[14]

In this respect Watson treats the concept of mind in much the same fashion as the associationists regard the problem of the substance of mind. But Watson's realistic position on the problem of explaining behavior is evident from other statements. He writes,

> Human action as a whole can be divided into hereditary modes of response (emotional and instinctive), and acquired modes of response (habit)[15]...

He describes each of the three phases of human action, emotion, instinct, and habit, in the following terms. With respect to emotion:

> A formulation which will fit a part of the emotional group of reactions may be stated as follows: An emotion is an hereditary "pattern reaction" involving profound changes of the bodily mechanism as a whole, but particularly of the visceral and glandular systems. By pattern reaction we mean that the separate details of response appear with some constancy, with some regularity and in approximately the same sequential order each time the exciting stimulus is presented.[16]

14. John B. Watson, Psychology from the Standpoint of a Behaviorist, p. 1.
15. Ibid, p. 224.
16. Ibid, p. 225.

With regard to instinct:

> We should define instinct as an hereditary pattern of reaction, the separate elements of which are movements principally of the striped muscles. It might otherwise be expressed as a combination of explicit congenital response unfolding serially under appropiate stimulation.[17]

With regard to habit:

> We can define habit then as we did instinct as a complex system of reflexes which function in a serial order when the child or adult is confronted by the appropiate stimulus, provided we add the statement that in habit the pattern and order are acquired, whereas in instinct they are inherited.[18]

The description which Watson gives of these patterns of reaction and systems of reflexes implies the existence of neural connections within the nervous system which will automatically produce a given response when a person is confronted with an appropriate stimulus. The inherited modes of response form the basis for the development of all forms of behavior. The behavior observable during man's first year of existence is characterized as follows:

17. John B. Watson, Psychology from the Standpoint of a Behaviorist, p. 263.
18. Ibid, p. 304.

> We find a multitudinous group of poorly integrated reflexes consisting of kicking, slashing with the hands and feet, and wriggling of the whole body, and the movements of the vocal cords.[19]

These become organized into integrated movements and responses by "the coordination or chaining together of the loosely knit acts into what we call 'learning' or habits."[20]

Watson uses the concept of the reflex arc to explain the chaining together of the acts. He states,

> Although the neurone is a unit of the nervous system it cannot function alone. It becomes functional from a conduction standpoint only when its connections are established. The functional unit of conduction is called the reflex arc.[21]

He assumes a definite one-to-one correspondence between a given stimulus and its response and that every fundamental reflex in the body has an appropriate stimulus for evoking that reflex. Watson does not explicitly state assumptions regarding the nature of ultimate reality in his discussion of learning or habit formation. However, his statements

19. Ibid, p. 4.
20. Ibid, p. 4.
21. Ibid, p. 143.

regarding the methods by which connections are established between neurones imply realistic assumptions on his part. The inherited reflexes, which he assumes, can apparently be set in motion only by external stimuli. Learning, chaining together of a complete system of reflexes which function "in a serial order," is the result of external stimuli impinging upon various sense organs.

Among others who contributed to the development of a system of psychology based upon these assumptions is the Russian physiologist and psychologist Pavlov. The particular emphasis for which he is responsible is the development of principles of conditioning. Conditioning, according to Pavlov, assumes the existence of inherited fixed connections between stimuli and responses. If any one of the inherited S-R sequences is selected for conditioning the "S" is known as the unconditioned stimulus. A new stimulus, "Sc," can be connected to the "R" by successive presentations of "S" and "Sc" simultaneously. Presentation of "Sc" alone will then be sufficient to evoke the "R." "Sc" becomes the conditioned stimulus.

The classical conditioning experiment which Pavlov introduced involved conditioning the salivary reaction of a dog. Successive presentations of an unconditioned

stimulus, food, simultaneously with sounding a bell made it possible for the salivary reaction to be elicited by sounding the bell alone. Pavlov's explanation of this phenomenon implies the assumption of a system of inherited reflexes of the same sort which Watson described. Pavlov's later experiments made it necessary for him to elaborate upon his description of conditioning but his basic assumptions apparently remained the same. He states,

> At the present moment, on the basis of thirty years of experimentation carried out by me together with my numerous co-workers, I feel fully justified in asserting that the total external as well as the total internal activity of a higher animal, such as a dog, can be studied with complete success from a purely physiological angle, i.e., by the physiological method and in terms of the physiology of the nervous system.[22].

If one assumes that all animal activity can be described entirely in terms of the physiology of the nervous system some concept such as inherited reflexes will almost certainly be used. It is evident that Pavlov assumes that behavior of a dog is determined entirely by certain conditions within the nervous system.

22. I. P. Pavlov, "A Brief Outline of the Higher Nervous Activity," Psychologies of 1930, (Carl Murchinson, Editor), p. 207.

The person who developed the most extensive application of these assumptions in the field of psychology is Edward L. Thorndike. His first notable publication on educational psychology consists of three volumes: I. The Original Nature of Man, II. The Psychology of Learning, and III. Mental Work and Fatigue and Individual Differences and Their Causes. Thorndike follows the position of both Watson and Pavlov in the belief that behavior can be explained on a purely physiological basis. In the first volume he states,

> Any man possesses at the very start of his life -- that is, at the moment when the ovum and spermatazoon which are to produce him have united -- numerous well-defined tendencies to future behavior. Between the situations which he will meet and the responses which he will make to them, pre-formed bonds exist. It is already determined by the constitution of these two germs that under certain circumstances he will see and hear and feel and act in certain ways...
>
> Any neurone will, when stimulated, transmit the stimulus, other things being equal, to the neurone with which it is by inborn organization most closely connected. The basis of intellect and character is this fund of unlearned tendencies, this original arrangement of neurones in the brain....
>
> They are the starting point for all education or other human control. The aim of education is to perpetuate some of them, to eliminate some, and to modify or redirect others. They are perpetuated by providing the stimuli adequate to arouse them and give them exercise, and by associating satisfaction

> with this action. They are eliminated by withholding these stimuli so that they abort through disuse, or by associating discomfort with their action. They are redirected by substituting, in the situation-connection-response series, another response instead of the undesirable original one; or by attaching the response to another situation in connection with which it works less or no harm, or even positive good.[23]

Thus all behavior is assumed to be explainable by the neurological connections which exist between the receptor and the effector organs of the body. All stimuli which impinge upon the receptor organs will automatically produce certain responses and these responses are dependent entirely upon the neural pathways which have been connected within the structure of the organism. The exact nature of this connection is not given by either of the three men whose work has been used to illustrate the realistic approach to psychology of the early twentieth century. Considerable discussion has taken place with regard to changes which the synapses might possibly undergo in order to provide the type of connection required by this theory. The working of the nervous system has occasionally been

23. Edward L. Thorndike, The Original Nature of Man, pp. 2-4.

likened to the operation of a telephone switchboard exchange. This analogy led to the popular conception that exercise of the stimulus-response sequence would cause the neurones to grow together at the synapses thus causing a direct, wire-like connection. Watson's use of the term "chaining together" suggests another analogy. Neural impulses set in motion by a stimulus might traverse the neurones and synapses in much the same way that motion is transmitted through a row of aligned billiard balls. This would require some condition within the synapses which would make certain that nerve energy would always follow in the same chain-like sequence.

The analogies or the descriptive terms are relatively unimportant. It is important, however, that behavior is assumed to be dependent upon some condition of the synapses. The response to any stimulus is considered to be dependent upon inherited or acquired synaptic conditions which will insure that $S_1$ will produce $R_1$ under ordinary circumstances. All psychological events are

assumed to be reducible ultimately to conditions within the nervous system which, given the proper equipment, could be observed and measured directly. This is an extension of the assumptions of philosophic Realism in the field of psychology; an extension required by the original assumptions regarding the existence of ultimate reality within the realm of matter.

Thorndike definitely suggests such thinking, as evidenced in the following quotation. It summarizes a lengthy discussion regarding the neurological basis for an explanation of behavior. He writes,

> In the above argument I have, chiefly to make a somewhat subtle theory easier to understand, assumed <u>movement</u> — spatial change — as a life process of the neurones. But <u>any process</u> whereby the neurone changes the nature of its connections with other neurones will serve all the purposes of the argument. The reader may, for instance, substitute appropiate terms referring to the 'greater or less permeability of a membrane' in every case where, in the last two pages, I have used 'movement of the end of a neurone in one direction or another.' The essence of my account of the physiological mechanism of learning may be stated as follows, independently of any hypothesis about the power of the ends of a neurone to move. The connections formed between situation and response are represented by connections between neurones whereby the distrubance, or neural current arising in one set of neurones is connected to another set across their synapses. The strength or weakness of the connection means

> the greater or less likelihood that the same current will be conducted from the former to the latter rather than to some other place. The strength or weakness of the connection is a condition of the synapse. What condition of the synapse it is remains a matter for hypothesis. Close connection might mean protoplasmic union, or proximity of the neurones in space, or a greater permeability to a membrane, or a lowered electrical resistance, or a favorable chemical condition of some other sort. Let us call this undefined condition which parallels the strength of a connection between situation and response the intimacy of the synapse.[24].

Thus while Thorndike does not state a definite hypothesis regarding the nature of the synaptic change he does state his assumption that behavior, being determined by connections, is dependent upon a condition of the synapse.[25].

The definition of learning which arose from this conception is that it is a process of habit formation. Pre-existing connections can be modified, strengthened, or eliminated. Thorndike proposes three laws to account

24. Ibid, pp. 226-227.
25. The term "neural connection" is used in this study to denote the neural relationship described by Thorndike in the above quotation when he states that the "strength or weakness of the connection is a condition of the snyapse." The term, as used, implies that behavior is assumed to be determined primarily by certain conditions within synapses, conditions which establish definite pathways for transmission of neural impulses.

for the process of stamping in connections. These three laws with their definitions are as follows:

> Law of Readiness is: When any conduction unit is in readiness to conduct for it to do so is satisfying: When any conduction unit is not in readiness to conduct, for it to conduct is annoying. When any conduction unit is in readiness to conduct, for it not to do so is annoying....
>
> The Law of Exercise comprises the laws of ~~the~~ Use and Disuse.
>
> The Law of Use is: When a modifiable connection is made between a situation and a response, that connection's strength is, other things being equal, increased.
>
> The Law of Disuse is: When a modifiable connection is not made between a situation and a response during a length of time, that connection's strength is decreased.
>
> The Law of Effect is: When a modifiable connection between a situation and response is made and is accompanied or followed by a satisfying state of affairs, that connection's strength is increased: When made and accompanied or followed by an annoying state of affairs, its strength is decreased.[36]

The process of learning implied in these laws consists mainly in repetition of stimulus-response sequences which are satisfying or which result in a satisfying state of affairs. The primary emphasis is placed upon repetition and Thorndike has been known popularly as the "champion of drill." There are indications in more recent

36. E. L. Thorndike, The Psychology of Learning, p. 1-4.

publications that Thorndike has modified his theory of learning from that which has just been reviewed. A detailed analysis of these recent publications will be undertaken in a later chapter of the present study.

The above references to the early position of Thorndike are intended only to illustrate the development of psychology under assumptions which are directly related to realistic philosophy. It has been shown that in this respect the positions of Watson, Pavlov, and Thorndike (prior to 1930) are similar. The main conflicts in psychology from 1930 to 1940, roughly, have been between the position of these men and that of relativistic psychologists. A summary of the latter point of view will be given next.

## D. Relativism as Applied to Psychology.

Systematic efforts to apply principles of relativity to the field of psychology did not appear until about the turn of the century. Since that time such application has appeared under the names of organismic, Gestalt, configurational, and field theory. Koffka poses the basic question regarding the possibility of introducing the field concept to psychological problems when he writes,

> Can we introduce the field concept into psychology, meaning by it a system of stresses and strains which will determine real behavior? If we can, we have at once

> a general and scientific category for all our explanations and we should have the same two kinds of problems which the physicist encounters: viz., (1) what is the field at a given time, (2) what behavior must result from a given field?[27].

The question of the explanation of behavior is one crucial issue on which a relativistic approach to psychology differs markedly from any of the explanations offered by absolutistic thinkers. The relativistic concept does not include the assumption that behavior is determined primarily by pre-existing conditions of the nervous system. It assumes rather that behavior is determined at all times by the environmental field which exists at a given time. The environmental field includes the organism, the goals and purposes toward which the activity of the organism is directed, and all phenomena (ideas, events, and things) which the organism senses as being related to successful attainment of a given objective.

The relativistic concept assumes that the environmental field is in a continual state of flux; that the organism is receiving stimuli at all times which require readjustment in terms of relating continually changing ideas and things to continually changing goals and purposes. To predict behavior one must know (a) the configuration of goals

27. Kurt Koffka, The Growth of the Mind, p. 42.

which an individual desires to achieve at a given time; (b) the confronting situation of objects, ideas, and events which he will encounter in his effort to achieve a goal; (c) the relationships which the individual comprehends as existing between the environment and his goals. This is different from the concept which regards the prediction of behavior as primarily a matter of discovering neural connections; a concept which assumes that if other things are equal a given stimulus will always evoke the response with which it is most closely connected.

Lewin discusses the difference between the statistical approach to a study of environmental influences and the descriptive approach. He describes the latter thus,

> These descriptions have attained what the statistical characterizations have most notably lacked, namely, a picture that shows in a definite way how the different facts in an individual's environment are related to each other and to the individual himself. The whole situation is presented with its specific structure. This means that the single factors of the situation are not given in characteristics which can be arbitrarily combined in a "summative" way. If psychology is to make predictions about behavior, it must try to accomplish this same task by conceptual means. In selecting methods and concepts we must use a pragmatic criterion: We have to find concepts on the basis of which predictions can be made. In other words our concepts have to represent the interrelationships of conditions.[28]

28. Kurt Lewin, Principles of Topological Psychology, p. 13.

A relativist believes that predictions of behavior can be formulated best by descriptions of interrelationships of conditions.

The application of relativistic principles to psychology requires an attitude toward the possible existence of unchanging attributes of human beings different from that which Realists or Idealists have assumed. Wheeler describes this changed attitude as follows:

> There is nothing absolute about the attributes, qualities, and performances of human beings. There is nothing absolute obtained from heredity, no fixed intelligence or particular traits of character. These like speed and distance, are relative to selected points of reference and sets of conditions. Both the points of reference and sets of conditions are subject to change.[29]

Wheeler formulates a series of statements which describe the relationships between the parts of any psychological field and the field as a whole. These are, in part, as follows: (1) The Law of Field Properties: Wholes exist in their own right over and above the parts or ingredients from which they were formed. (2) The Law of Determined Activity: The whole regulates the activities of its parts, or, the whole conditions the activities of its parts. (3) The Law of Derived Properties: The

29. R. H. Wheeler, and F. T. Perkins, Principles of Mental Development, pp. 10-11

properties of the parts are derived from the wholes of which they are members. (4) The Law of Individuation: When the whole is the frame of reference, parts come into existence through a division process that can be called individuation.[30]

Essential contrasts between an absolutistic and a relativistic point of view with respect to a conception of learning are given by Boyd. H. Bode in the two books previously mentioned. These texts represent an important development for contemporary theories of learning as they focused attention upon the fact that the laws proposed by realists might not, after all, explain the learning process as adequately as had been supposed.

The conception of learning derived from relativistic psychology is that learning is a matter of sensing the relationships among various aspects of the confronting situation so as to enable the learner to cope effectively with new situations. A relativist would apply this conception to all learning situations, from the simplest to the most complex. It is in opposition to the belief that an individual will be able to function effectively in a given situation if and only if he has repeated a stimulus-response sequence often enough to stamp in a neural connection. In relativistc terms, an individual will be able to

30. R. H. Wheeler, The Science of Psychology, (Revised Edition), p. 26 ff.

function effectively with respect to the goal which he is striving to achieve, if he has (a) insight into the relationships which exist among the relevant features of the confronting situation, and (b) insight as to how to use these features to promote progress toward his goal.[31].

Salisbury describes this conception of learning in these words,

> Learning is not specific, if by this is meant that we learn things in isolation. The products of learning tend to become specific, if by this is meant that they gain individuality as differentiated units functionally related to other units within a complex, larger whole. Learning is essentially relational; it is essentially a process of differentiation; it comes through the reorganization of the stream of experience. It is a whole-to-part process in which the organism becomes adjusted to the circumstances of life through the reorganization of the total behavior and the development of first one part of the total and then another. In this reorganization, dominant patterns are developed from the consistencies of varied experience; past experience and vicarious experience join with present firsthand experience to form a broad base on which concepts and generalizations are formed.[32].

31. The term "insight" is used in this study to denote a sensing or grasping of relationships which exist among various aspects of a behavioral situation. It is a "comprehension of means-consequence patterns." (Arthur I. Gates, Educational Psychology, 1942, p. 343.) The phrase "sensing (or sense) of relationships" is used interchangeably with the term insight.
32. Frank S. Salisbury, Human Development and Learning, p. 249.

Or, more specifically in the following three statements,

> ... Life at all levels seems to be relational in its nature; growth, maturation, and learning are different aspects of the continuous process of establishing working relations with the world without.[33].

> ... As might be expected from our previous study, learning proves to be a matter of organizing and reorganizing the whole of the life of the individual; the particulars of human behavior are always what they are because of the part they play in the larger whole of development of a particular individual.[34].

> ... If we interpret learning as a progressive organization of human behavior to meet the new in the environment, it should be possible to gain an insight and understanding which will recognize the change taking place in the learner and the purpose that makes the change significant.[35].

Some of the phenomena of learning which a relativistic conception seems able to explain more effectively than can the opposite view are those numerous occasions when an individual acts correctly with respect to his objective when confronted with a new situation for the first time. The relativistic assumption that behavior is determined by the way in which an individual "sizes up" the situation can account for correct action the first time. On the other hand, if behavior is determined by neural impulses following pre-fixed paths, an individual would be required

33. Ibid, 158.
34. Ibid, 180.
35. Ibid, 181.

to practice a given situation several times if learning is essential to development of ability to respond correctly. It appears difficult, if not impossible, to explain this type of adjustive behavior with an assumption that behavior is dependent upon a pre-arranged condition of the synapses.

The relativistic emphasis includes the belief that correct action the first time is the ideal of learning. If one senses the relationships correctly in each new situation, and is thereby enabled to reach his goal immediately, without error, then learning is thorough. In many cases it is unnecessary to practice a task in order to insure successful performance the first time a new confronting situation is introduced. This is illustrated repeatedly in Kohler's experiments with apes. The performance of the animals demonstrated that they do not carry out a rehearsed program of activities, but that they respond to new situations with corresponding variations. Kohler describes the performance of one of the apes thus,

> When Sultan for the first time pulled one stick towards himself with another, the test went very smoothly on favourable ground. But the next time the stick encountered a pebble while he was drawing it to him, and so he could not get it any farther, as it was turned round and pointed straight towards him (lying lengthwise). The animal stopped <u>at once</u>,

> first pushed the stick, with careful little pokes of the second stick, crosswise again, and then pulled it to him. One may truthfully say that in the majority of cases when the stick is used, the solving of the chief problem brings in its course small, unforeseen additional problems, and that, as a rule, the chimpanzee immediately makes the necessary modifications. Of course there are limits here, too -- they will be dealt with in the next chapter -- but we are not asserting that the chimpanzee can do as much as an adult man, on the other hand, it would simply be nonsense to assert that the animal has gone through special combinations of accidental impulses for all these different cases of variation.[36]

The relativistic conception of learning as applied to teaching involves giving the student opportunities to develop insight with respect to various types of problems which confront individuals in everyday situations. This is in contrast to the opposite view which assumes that responses to everyday situations are dependent upon fixed sequences of acts rather than upon insight. Development of insight implies a sensing of relationships among various aspects of confronting situations. If the relationships within confronting situations are apparent from the outset, an individual can react effectively at once. If the relationships are not apparent immediately, reflection upon probable consequences of this or that course of action is a prerequisite of intelligent behavior.

36. Wolfgang Kohler, The Mentality of Apes, pp. 216-217.

The type of teaching required to promote intelligent behavior where the situation and meaning occur simultaneously may be somewhat different from that required where the meaning is not apparent from the outset. Methods applicable to the latter case are described by E. E. Bayles as follows:

> Teaching which promotes reflection level thinking is problem teaching. Pupils have to be brought face to face with problems which challenge them; with I-don't-know situations about which they are really concerned. Such teaching might be thought of as involving two phases -- a problem-raising and a problem-solving phase. Right-answer teaching, in which pupils are handed ready-made answers and held responsible simply for knowledge of those answers, is not problem teaching. In problem teaching, several alternative answers for each and every question are formulated and given careful consideration, and each pupil is held responsible for choosing the answer which he himself finds to be most tenable in the light of the data and of other considerations arising during the study.[37]

This activity, concerned entirely with collection and organization of data relative to a given problem, is the kind of practice that develops ability to cope effectively with an entirely new situation the first time. Since

37. E. E. Bayles, "The Relativity Principle as Applied to Teaching," University of Kansas Bulletin of Education, p. 9

a relativistic philosophy directly attacks the problem of learning to deal with new and constantly changing situations, the teaching described above belongs within the framework of this philosophy.

The foregoing presentation of the applications of relativistic principles in the field of psychology indicates the general nature of the conflicts which have arisen between this view and the realistic approach represented by Watson, Pavlov, and Thorndike. The professional educational and psychological journals printed numerous articles, from about 1920 on, which present one or the other of the two sides in the controversy. Three main points on which this divergence of opinion has particular significance for a psychology of learning have been selected by the writer for discussion in the following section.

## E. Fundamental Issues on which Relativistic and Absolutistic Views of Psychology Diverge.

In addition to the foregoing discussion of important developments in the historical growth of the conflicting points of view, it will be useful to the present study to contrast more sharply the differences which exist in certain fundamental issues. The presentation will

represent an application of principles from the opposing views to specific problems related to a psychology of learning.

First, an important divergence exists with respect to conceptions regarding the definition and nature of experience. An absolutist regards experience as dependent primarily upon the nature, number, and variety of sense impressions which an individual receives. Experience itself is regarded as the mental image or concept which is automatically built up by sense impressions. Thus "to experience a situation" means that an individual is confronted with a pattern of stimuli which set in motion neural impulses, and that the summation of sense impressions transmitted represents the experience obtained.

Watson indicates this concept when he describes the development of experience on the part of a child with respect to a flame. He describes the process of presenting a lighted candle to a child several times in succession and tapping his fingers each time he reaches for the object. He believes a negative reaction to a candle flame can be conditioned in this manner. He says, "A child can be conditioned by a severe burn with one stimulation, but this always involves a severe reaction ..... Building in negative responses without shock

requires time, however."[38]. The child's experience with regard to a flame is dependent, according to Watson, upon the number of times his fingers have been tapped when reaching for a flame or upon the strength of sense impressions received if the child is burned.

A relativist regards experience as dependent upon two factors, (a) active trying-out of a plan of action, and (b) realization of the consequences of such action. Sense impressions are used in this process, but relating actions to consequences is the primary factor; not summation of sense impressions. Thus, to experience a situation means that an individual attempts to establish a working relationship among the elements of a situation and undergoes the consequences which result from his action.

Dewey indicates this concept when he discusses the same experience situation as Watson described. Dewey states,

> It is not experience when a child merely sticks his finger into a flame; it is experience when the movement is connected with the pain which he undergoes in consequence. Henceforth, the sticking of the finger into a flame <u>means</u> a burn. Being burned is a mere physical change, like the burning of of a stick of wood, if it is not perceived as a consequence of some other action.[39].

38. J. B. Watson, "What the Nursery has to say about Instincts," <u>Psychologies of 1925</u>, p. 70.
39. John Dewey, <u>Democracy and Education</u>, p. 163.

The child's experience is dependent, according to Dewey, upon relating a given act to its consequences, not upon the number of times the child has been burned nor the degree of severity of a single burn.

One further illustration will suffice to emphasize the contrast between the two points of view. Ideas or concepts are an important part of human activity and ideas are an expected outcome of learning. Development of the idea of roundness can serve as an illustration of the divergence between relativism and realism in this phase of psychology. A strict realist believes that the idea of roundness can be developed basically by repeated presentations of round objects to an individual. If an individual sees a sufficient number of round objects an idea of roundness is the outcome, due to summation of impressions. If he touches round objects, the idea developed by touch sensations combines with the idea developed by sight sensations to form a more accurate representation of roundness; a reality assumed to exist within the realm of physical objects.

A relativist believes that an idea of roundness may exist without reference to physical objects. An individual may define his concept of roundness in any way he chooses, but having formulated his idea he must be able to use it

effectively in dealing with objects or other ideas; else it has no value. For example, an individual may define roundness as that aspect of objects which will cause the projection of its shape upon a flat surface to assume the form of a circle. (Prior definition of a circle is assumed.) If the individual now selects a group of objects which he claims are round, the accuracy of his idea of roundness depends upon the extent to which the projections of the shape of the selected objects conform with the original definition. For this view ideas or concepts are not dependent upon summation of sense impressions.

Second, an important divergence exists with respect to the conception regarding the relation of goal or purpose to behavior. For a realist, behavior is determined primarily by pre-existing bonds. The stimuli in a situation start nerve impulses on their way and the response is determined by the synaptic connections which cause a particular set of neurones to be activated. With respect to a given stimulus pattern, behavior is mechanical -- non-purposive.

Thorndike says for example, "All original tendencies are aimless in the sense that foresight of consequences

does not effect the response."[40]. It is true, of course, that the nervous system is required to produce a response. The point at issue is, to use Thorndike's terminology, whether responses are purposive or aimless. Watson, apparently unintentionally, supports a purposive view when he describes the instinct of crying as it develops in young children. He states,

> Crying as such very shortly becomes conditioned. The child quickly learns that it can control the responses of nurse, parents and attendants by the cry, and uses it as a weapon ever thereafter.[41].

This assumes foresight of consequences on the part of the child. Yet neither Watson nor Thorndike recognize this factor in their fundamental theories of learning. According to their statements[42] regarding the development of learned behavior, conditioning the act of crying involves formation of direct neural connections between a given set

40. E. L. Thorndike, Educational Psychology, Vol I., The Original Nature of Man, 1923, p. 136.
41. John B. Watson, "What the Nursery Has to Say About Instinct," Psychologies of 1925, p. 18.
42. These statements have already been quoted in full. Watson states, in part, "We can define habit then as we did instinct as a complex system of reflexes which function in a serial order when the child or adult is confronted by the appropriate stimulus, ...." Thorndike states, in part, "Any man possesses at the very start of his life .... numerous well-defined tendencies to future behavior. Between the situations which he will meet and the responses which he will make to them, pre-formed bonds exist. .... They are the starting point for all education or other human control."

of stimuli (a furry object, for example) and the crying response. When crying has been conditioned, then, presumably, a child will cry whenever the conditoned stimuli appear. Foresight of consequences has no place in such a scheme.

A relativist assumes that all behavior is purposive. It must be interpreted in the light of the goal which an individual sets out to achieve. Instead of assuming mechanical action, a relativist assumes that all behavior represents adjustments on the part of an individual in his effort to attain a goal within a given situation. Behavior is dependent upon the purposes of an individual and the manner in which he sees himself as related to his environment and these purposes. Thus a given stimulus pattern does not necessarily evoke the same response each time it is presented. In fact, a relativist believes that it is unlikely ever to do so, even if it should ever recur, since both purpose and insights will probably have changed.

This point of divergence has an important relationship to the field of experimental research in psychology. Contemporary psychologists base their theories of learning upon experimental data, but often fail to take into account the basic assumptions under which the experiments are

organized. Kohler [43] points out the manner in which the goals and purposes of a subject may modify a psychological experiment. An experimenter sets up his procedure so that the stimulus is the outstanding feature of the situation — that is, it appears to the experimenter to be the outstanding feature. But one cannot be sure that the subject will regard the stimulus as the outstanding feature. An objective situation may appear very different to different people. Kohler suggests that, for non-human animals at least, it is very improbable that an animal will have the same organization of a situation which the experimenter has and which the experimenter believes the animal has.

Many conditioning experiments show the importance of taking into account the relationship between purposes and results. Hilgard and Marquis[44] discuss the effect of a subject's attitudes and purposes in conditioning experiments and indicate that, "with human subjects the results of any conditioning experiments will tend to be complicated by the influence of voluntary factors."[45] They mention three types of procedure which have frequently been adopted in order to minimize the effect of these factors. To quote:

43. Wolfgang Kohler, "Intelligence of Apes," Psychologies of 1925, p. 149, ff.
44. E. R. Hilgard and D. G. Marquis, Conditioning and Learning, pp. 270-272.
45. Ibid, p. 270.

> In the first place, subjects can be selected which do not have the capacity for appropriate voluntary reactions. For this reason, animals and young infants have been found to be "good" subjects. Second, a response may be selected for study over which the subject has a minimum of voluntary control. ... Third, although the subject is capable of a degree of voluntary control over the conditioned response, the experimental conditions may be so arranged that this control is not exercised... For example, the subject may be given no knowledge concerning the purpose of the experiment, or of the stimulus sequences to be employed. Subjects may be selected who have not had previous experience with conditioning. The subject may be instructed to take a passive attitude, and not to control any responses he may make. Since any normal person is bound to take some attitude toward the rather unusual experimental conditions with which he is confronted, some experimenters have sought to distract the subject so that he will not notice the relevant features of the situation.[46]

A relativist assumes a definition of learning in terms of goals and purposes which does not require him to attempt such restrictions upon experimental subjects. In fact a relativistic explanation of experimental results includes these voluntary factors as one of the primary sources of data, rather than attempting to exclude such data from the experiment. Recognition of differences which exist among subjects in any experimental situation seems to require a definition of learning which permits interpretation of such.

46. Ibid, p. 272.

The third important point of divergence is with respect to the function of a synapse in learning. A realist assumes a response to be dependent upon a fixed condition of the synapses. That is to say, the pathway taken by neural impulses is determined by pre-existing synaptic conditions. These conditions are regarded as the reasons why certain paths are taken by neural impulses traversing the synapse rather than others. These synaptic conditions are either inherited or acquired, according to a realist. The process of acquiring them is based upon an assumption that passage of a single neural impulse across a synapse produces some relatively permanent change within the synapse which will increase the probability that a new impulse initiated by recurrence of the original stimulus will follow the identical synaptic pathway. If a neural impulse traverses the identical synaptic pathway a sufficient number of times, then a new pathway is "fixed."

In contrast with this view, a relativist assumes that behavior is dependent upon a psychological field. That is to say, the pathway taken by neural impulses is determined by factors within the psychological field, namely, conditions within the organism, the confronting situation, the goals and insights which the organism has. These conditions within the psychological field are regarded as the cause of certain paths being taken by neural impulses

traversing the synapses rather than others. A relativist sees no reason for assuming that passage of a neural impulse across a synapse modifies the synapse in any way such as to account for subsequent changes in behavior. Thus, if two impulses follow the same path across a synapse it is assumed to be due to identical conditions within the psychological fields rather than to conditions within the synapse. The configuration of conditions which causes an impulse to traverse a synapse in a certain way the first time is sufficient to cause subsequent impulses to follow the same path.

From the foregoing it is evident that a relativist recognizes that synapses function in behavior. He believes, however, that the hypotheses which realists have made with respect to synapses are inadequate. A relativist does not attempt with present knowledge to explain how nervous structure is organized for the control of behavior; a realist attempts to give such an explanation and uses it as the basis for his theory of learning. A relativist believes that field conditions determine behavior and bases his theory of learning upon a gross but experimentally usable statement of these conditions.

The foregoing provides background for the present study of contemporary theories of learning. The views of modern writers will be analyzed in the following chapters

to determine their position with respect to the basic conflicts which have been presented. The position of a contemporary writer who deals specifically with the problem of possible reconciliation of differences among learning theories will be presented first.

# CHAPTER III

## RECONCILIATION OF LEARNING THEORIES AS PROPOSED BY T. R. McCONNELL

### A. Forty-First Yearbook, Part II, National Society for the Study of Education.

It is believed that the work undertaken by the committee for the 41st Yearbook is the most representative in current literature of studies which seek to effect reconciliation among conflicting theories of learning. As chairman of the committee, T. R. McConnell wrote both the introductory chapter and Chapter VII, the latter entitled "Reconciliation of Learning Theories." Most of the data for the present section of our study will be taken from these two chapters. The Yearbook includes a second part which contains practical applications of the principles of learning "common to the theories of learning outlined in the first section."[1] The present study will make no reference to the second part.

The purposes of the Yearbook are stated as follows:

> The purposes of this Yearbook are (1) to provide a concise and authoritative statement of three of the most active and influential theories of human learning; (2) to show that although there are differences among them, these systems possess many fundamental points of agreement which are often obscured by different terminologies, and that these common

1. T. R. McConnell, "Introduction," 41st Yearbook, N.S.S.E., p. 12.

> principles constitute a sound and positive basis upon which constructive educational thinking and practice can proceed; (3) to indicate that the theoretical positions are to a considerable degree complementary, each making a useful contribution to a comprehensive description of the learning process; and (4) to present in a manner primarily constructive and only incidentally controversial, a discussion of some of the more important phases and conditions of human learning which are particularly significant for education.[2].

The data upon which McConnell bases his proposals are taken mainly from contributions submitted by six psychologists. The three points of view represented are: (a) conditioning, (b) connectionism, and (c) field theory. The theory of learning based upon conditioning is presented by E. R. Guthrie and Clark L. Hull. There are, as[3] McConnell points out, certain differences between the views of these two men. However, the disagreement is primarily on theoretical points.[4]. For example, Hull is willing to accept many of the practical suggestions of Guthrie.[5].

2. Ibid, p. 3.
3. Ibid, p. 4.
4. Ibid, p. 6.
5. Clark L. Hull, "Conditioning: Outline of a Systematic Theory of Learning," 41st Yearbook, N.S.S.E., p. 93. "In spite of certain sharp differences between the primary assumptions of Professor Guthrie's chapter and this one, the two systems have a strong kinship; if practical morals were to be drawn from the present system they would agree almost in detail with those put forward by Professor Guthrie."

The view of connectionism is written by Peter Sandiford and Arthur I. Gates, both of whom present their interpretations of Thorndike's position. It was the original intention of the committee to have Thorndike summarize his own view, but he was unable to do so. Because of the fact that Sandiford's interpretation differed considerably from that currently held by other students of Thorndike, Gates was asked to submit his interpretation.[6]. The discussion which Gates presents purports to show that connectionism and field theory are not far apart in their educational implications.[7]. Theories of learning derived from field theory are presented by George W. Hartmann and Kurt Lewin. Hartmann's treatment of the subject omitted the particular development which Lewin has promoted and for this reason Lewin was asked to present his view.[8].

The committee recognizes that the three systems of thought selected for presentation do not include all the differences among theories of learning. "It seemed to the committee, however, that the three theories presented are the principal protagonists in the contemporary scene, and therefore it would be useful not only to outline them

6. T. R. McConnell, op. cit., p. 5.
7. Ibid, p. 6. "The pedagogical implications of Sandiford's treatment of connectionism would seem to clash with many of Hartmann's educational proposals, but Gates insists that connectionism as he interprets it can embrace most of the broad educational applications of field theory which Hartmann makes in his chapter."
8. Ibid, p. 5.

but also to inquire into the extent of their similarity."[9]. They take the position that, for the purposes of the Yearbook, the differences are less important then the similarities. This is indicated by the following:

> It is not inherently undesirable, of course, to pay attention to important theoretical distinctions. Defining these issues may, in fact, stimulate research into fundamental problems of learning in the laboratory or in the school. But over-emphasizing the differences serves to give the impression of utter confusion and perhaps of futility, and may suggest that there are no positive psychological principles upon which educational practice can be based. If there are substantial points of similarity among the dominant schools (and several attempts at synthesis indicate that such agreements really exist) or if the systems are to a considerable degree complementary, it should be possible to point out certain fundamental principles of learning which can be confidently accepted, for the time being at least, as the foundations of a sound educational program.[10].
>
> Although differences of emphasis and degree exist among theories of learning, a degree of commonality can be found among them. Furthermore, although certain phases of the learning process, such as goal-behavior, have a different <u>systematic</u> significance from one theory to another, they may point to approximately the same <u>practical</u> consequences.[11].

The difference between the approach to the problem of harmonization indicated in the Yearbook and the purposes of the present study should be pointed out. McConnell

9. Ibid, p. 4.
10. Ibid, pp. 8-9
11. T. R. McConnell, "Reconciliation of Learning Theories," <u>41st Yearbook, N.S.S.E.</u>, p. 356.

emphasizes the discovery of similarities among the systems rather than the harmonization of conflicting theoretical positions. It is assumed in the Yearbook that if a sufficient degree of similarity can be established among the practical consequences which the six psychologists suggest, a fundamental principle of learning can be formulated which will have value for the present educational program. There is no attempt to reconcile the conflicts which may be present between the theoretical views, except as they can be shown to be complementary. The present study, on the other hand, will attempt to determine whether the proposals submitted by McConnell are likely to produce serious conflicts in classroom teaching procedures.

E. R. Guthrie discusses learning chiefly in terms of stimulus and response. He states that if we are interested in what a child will learn and the circumstances under which he will learn it, "we must turn to the observation of what he does (the responses) and the occasions for these responses (stimuli). Responses, the answers to stimuli, are limited to the contraction of muscles or the secretion of glands."[12] He states as his principle of association: "A stimulus pattern that is acting at the time of a response

12. E. R. Guthrie, "Conditioning: A Theory of Learning in Terms of Stimulus, Response, and Association," 41st Yearbook, N.S.S.E., p. 20.

will, if it recurs, tend to produce that response."[13]. As a corollary of the principle of association he writes that "we learn only what we do."[14]. He places considerable emphasis upon the activity in which the person is engaged during the learning process. He describes, for example, a rote learning situation in the classroom, in which a schoolboy learns the material in a seated position. If the boy is then asked to recite the material in a standing position he is likely to fail. He implies that the lack of ability to recall in this situation is due primarily to the fact of a physical change in body position.[15]. Guthrie differs from field theory with respect to his interpretation of the relation of goals to behavior. He states, "Goals do not determine activity; but stimuli may incite activity that is directed toward a goal previously attained by the activity because the stimuli remain associated with the movements that ended in the goal attainment."[16]. These statements indicate that Guthrie's position does not differ to any appreciable extent from traditional conditioning theory, at least with respect to the assumption that behavior is determined by some change in conduction units which produces a permanent stimulus-response sequence.

13. Ibid, p. 23.
14. Ibid, p. 24.
15. Ibid, p. 32. "But we find that any radical change in the boy's position brings failure to remember. If he practiced in his seat and is now standing his memory will be impaired. If he is asked to stand before the others and sing the song through, the chances of failure approach certainty. He has not practiced in these situations."
16. Ibid, p. 52.

Clark L. Hull presents an elaboration of conditioning theory based upon "molar laws or coarse rules" which describe how neural impulses acting between receptor and effector organs account for behavior. "The aggregate of these molar laws, supplemented by occasional bits of neurophysiology, largely make up the present primary principles or postulates upon which the theory of behavior is based."[17]. He stresses the complexity of stimuli as in the statement: "But the environment is usually very complex and the state of even a small part of it, such as a vibrating tuning fork, may be conveyed to the organism by numerous receptor modes jointly, e.g., through vision, sound, and touch; moreover, each receptor mode is mediated by the central afferent discharges of great numbers of individual receptor organs such as retinal rods and cones, auditory hair cells, the cutaneous receptors at the base of the hairs of the skin, and so on. Thus the stimulus (S) which is involved in the setting up of a habit, despite the grammatically singular form of the expression, is probably in all cases an exceedingly complex compound of physical energy elements."[18]. In agreement with the stress which he places upon the complexity of the situation, Hull suggests that Pavlov's description of his conditioning experiments ignored part of the complete picture. That is, that Pavlov did not

17. Clark L. Hull, "Conditioning: Outline of A Systematic Theory of Learning," 41st Yearbook, N.S.S.E., p.64.
18. Ibid, pp. 66-67.

consider the fact that the dog ate the food after each conditioning trial as relevant to the description.[19] Hull endeavors to show that "the conditioned reaction is a special case of the 'law of effect'".[20] The law of effect, as Hull uses the term, follows the Thorndikian definition in its basic features.[21] A more complete analysis of Hull's position will be undertaken later in this study.

Peter Sandiford's interpretation of Thorndike places it squarely within the framework of absolutistic thinking. He writes that, "Connectionism boldly states that learning is connecting. The connections presumably have their physical basis in the nervous system where the connection between neuron and neuron explain learning. Hence, connectionism is also known as the synaptic theory of learning.[22] He traces the close historical relation between connectionism and the associationism of Locke, Hartley, Bain, and others. He cites also the modifications which Thorndike has introduced and believes that belongingness "is not unrelated to certain Gestalt doctrines, including insight."[23] However, he believes that these modifications "do not destroy the main fabric of the

19. Ibid, pp. 68-69.
20. Ibid, p. 72.
21. Ibid, p. 65.
22. Peter Sandiford, "Connectionism: Its Origin and Major Features," 41st Yearbook, N.S.S.E., p. 98
23. Ibid, p. 127.

connectionistic doctrine."[24] He mentions thework of Lashley and recognizes that "Here is a definite challenge to the connectionistic theory of learning."[25]. Sandiford's adherence to connectionistic principles is probably due to the fact that he believes that: "Educationally, the bond theory of learning, which is based on the synaptic theory, is still the most valuable for schoolroom use, and need not be discarded by teachers, even if the synaptic theory is modified beyond recognition."[26]. Or again, "While learning may not be all analysis and selection, it is difficult to conceive learning in which these elements did not play a preponderant role. Therefore, by the pragmatic test of success in the work-a-day world of teaching, connectionism deserves our highest respect.[27].

On the other hand, Arthur I. Gates takes the position in his chapter in the Yearbook that the term "bond" or "connection" does not imply any kind of neural linkage whatsoever. "The term connection, bond or tendency, does not refer to any neurological concept or agent at all. It refers to a functional relation between a situation and a response. It refers to an observed phenomenon and implies no neurological correlate. It implies nothing except that

24. Ibid, p. 128.
25. Ibid, p. 131.
26. Ibid, p. 132.
27. Ibid, p. 137.

there is an observed tendency for a situation to be followed by a response."[28]. He states that Thorndike's "law of effect" is the most vital principle of learning[29]. because the law emphasizes the decisive role the organism has in determining its own course of action. In fact, Gates believes that "the basal idea of the organism's own potency in influencing its own course of learning is the keystone of the Thorndike psychology of learning."[30]. With regard to insight Gates writes that, "For Thorndike, insight is based on response to subtle features of a situation; it is correct insight when the proper features become prepotent and incorrect insight when the wrong features elicit responses."[31]. Gates continues by pointing out the similarities between Thorndike and Woodworth on the one hand and Gestalt psychologists on the other with regard to trial and error, drill, and motives and purposes. He concludes that "while there are definite differences between 'organismic' and 'stimulus-response' psychology in certain underlying explanatory concepts, there is very little difference in the professional or practical implications of the 'organismic' view sketched by Hartmann in chapter V and the 'stimulus-response' view held by Thorndike and Woodworth."[32].

28. Arthur I. Gates, "Connectionism: Present Concepts and Interpretations," 41st Yearbook, N.S.S.E., p. 145.
29. Ibid, p. 147.
30. Ibid, p. 149.
31. Ibid, p. 156.
32. Ibid, p. 163.

George W. Hartmann discusses the general concept of a "field" as applied to all areas of science and then proceeds to apply the concept specifically to psychological problems. Field theory implies that "All events in nature -- and this statement plainly includes psychological and educational phenomena -- always occur within some field, big or little, whose properties and structure explain the localized occurence that it embraces and simultaneously permit increased control over it. The so-called inherent properties of an object are said to be ultimately traceable to forces impinging upon it from the surrounding field which is construed as the effective whole determining the attributes and behavior of the part or parts coming within its influence."33. Hartmann traces the historical development of field theory and presents numerous illustrations of the application of this view to visual phenomena. He discusses also the comparison of rote and logical memory as applied to learning lists of nonsense syllables and lists of meaningful words. In this connection he believes that "Even a nonsense syllable has some meaning to the learner -- to identify it correctly as a nonsense syllable is a prerequisite to to certain appropiate conduct in connection with it. An experience with zero meaning is psychologically non-existent.

33. George W. Hartmann, "The Field Theory of Learning and Its Educational Consequences," 41st Yearbook, N.S.S.E., p. 166.

Rote learning, the curse of all inadequate instruction, defines one end of the meaning continuum and logical or 'systematic' learning the other; but absolutely it is present all along the line.[34].

Kurt Lewin describes one of the basic characteristics of the field theory approach to psychology as "the demand that the field which influences an individual should be described not in 'objective physicalistic' terms, but in the way in which it exists for that person at that time ..... To describe a situation 'objectively' in psychology actually means to describe the situation as a totality of those facts which make up the field of that individual. To substitute for that world of the individual the world of the teacher, of the physicist, or of anybody else is to be, not objective, but wrong."[35]. Lewin distinquished four types of changes which occur within learning: "(1) learning as a change in cognitive structure (knowledge), (2) learning as a change in motivation (learning to like or dislike), (3) learning as a change in group belongingness or ideology (this is an important aspect of growing into a culture), (4) learning in the meaning of voluntary control of the body musculature (this is one important aspect of acquiring

34. Ibid, p. 190.
35. Kurt Lewin, "Field Theory and Learning," 41st Yearbook, N.S.S.E., p. 217.

skills, such as speech and self-control.)"[36] The remainder of the chapter deals with the application of principles of field theory to each of these four changes.

McConnell develops his chapter on reconciliation from the data presented by these six writers. As indicated in the introduction to the Yearbook, he stresses the similarities which are to be found. It is evident throughout the chapter that he encounters considerable difficulty in bringing the positions of Guthrie and Sandiford in line with the positions of the other four writers. The main points of similarity then are between the Gates-Hull position on the one hand and the Hartmann-Lewin position on the other.

McConnell lists nine points on which similarities among the theories of learning are apparent. The first two deal with the complexity of situation and response. They are:

> 1. Both Situation and Response are Complex and Patterned Phenomena.
> 2. Descriptions and Interpretations of Learning, As of All Aspects of Behavior, Must Be Made in Terms of the Mutual Relationships Among Events Rather Than in Terms of Independent Properties or Actions of the Parts.[37]

36. Ibid, p. 320.
37. T. R. McConnell, op. cit., pp. 256-258.

In his discussion of these two points he places little emphasis upon the fact that there may be a fundamental difference in the manner in which these complex situations and responses are regarded as being related to behavior. If one assumes that complex behavior patterns can all be reduced to simple units of stimulus-response relationships, his explanation of behavior will necessarily be different from that proposed by one who assumes that complex behavior patterns are to be explained on the basis of relationships within a given field.

This difference in approach is apparent in the material which McConnell has included. For example, in describing how Hull makes use of the principle of neural interaction, McConnell writes,

> He has explained the fact that gray paper on a blue ground will appear to have a yellow tinge (Hartmann uses the same kind of phenomenon to illustrate the action of field forces) by the hypothesis that neural impulses occurring together in the central nervous system interact and modify each other.[38]

He does not, at this point, include Hartmann's explanation but merely indicates that both are offering complementary explanations for the same phenomenon. McConnell is aware of the differences between the two explanations but assumes,

38. Ibid, p. 259.

as indicated previously, that the same practical consequences are implied regardless of these differences. To the present writer this assumption is highly questionable since a theory of learning based upon a single unit of behavior such as the reflex-arc implies formation of fixed sequences of acts even though both situation and response may be considered as extremely complex and interrelated. The issue of the use or non-use of the reflex-arc concept is still present regardless of apparent recognition, on the part of psychologists holding various views, that situations and responses are complex and interrelated.

The next four points of similarity which McConnell lists deal with related topics. They are:

> 3. The Organism Must Be Motivated to Learn.
> 4. Responses During the Learning Process are Modified by Their Consequences.
> 5. "Motivation is the Direction and Regulation of Behavior Toward a Goal."
> 6. So-called Trial-and-Error Behavior Might Be More Appropiately Described as a Process of 'Approximation and Correction' or of 'Trying This-and-That Lead to the Goal.'[39].

Agreement on these points is not unanimous, as McConnell points out, since Guthrie does not believe that responses are modified by their consequences. However, the agreement

39. Ibid, p. 262-269.

which McConnell presumes to find may not be as real as suggested. Since both Sandiford and Gates interpret Thorndike for the Yearbook, it is advisable to refer to Thorndike directly. It appears that Thorndike does not agree, in his earlier writings at least, with the implications of the above four points.

For example, Thorndike's reference to the aimlessness of original tendencies, cited in the previous chapter, indicates that his interpretation does not require the assumption that connections are effected by the consequences of a response or by an individual's awareness of a goal. Furthermore, according to Thorndike (Educational Psychology, 1914), connections are formed without regard for goal or consequences. He writes,

> Denote by a b, a g, a l, a q, a v, and a B certain situations alike in the element a and different in all else. Suppose that, by original nature or training, a child responds to these situations respectively by $r_1$ $r_2$, $r_1$ $r_7$, $r_1$ $r_{12}$, $r_1$ $r_{17}$, $r_1$ $r_{22}$, $r_1$ $r_{27}$. Suppose that man's neurones are capable of such action that $r_1$, $r_2$, $r_7$, $r_{12}$, $r_{17}$, $r_{22}$, $r_{27}$, can each be made singly.
>
> If now the situations, a b, a g, a l, etc., are responded to (each once), the result by the law of exercise will be to strengthen bonds as shown in Scheme A, the situation-elements noted in the top line of the table being bound to each of the response-elements noted at the left side of the table as noted by the numbers entered in the body of the table.

> The bond from a to $r_1$, has had six times as much exercise as the bond from a to $r_2$, or from a to $r_7$, etc. In any new gross situation, a$\theta$, a will be more predominant in determining response than it would otherwise have been; and $r_1$ will be more likely to be made than $r_2$, $r_7$, $r_{12}$, etc., ....[40].

Formation of bonds in this fashion depends upon an interpretation of "trial and error" which is definitely opposed to McConnell's, of "trying this and that lead to the goal." Principles of learning derived from assumptions implied in Thorndike's description can not lead to the same practical consequences as principles derived from recognition of the relationship which an individual's goals have to his response. (Possible revisions in Thorndike's position are considered in a later section of the present study.)

The foregoing difference exists also if one considers Thorndike's reference to the law of effect. McConnell includes data which indicate a difference on this point, but, probably because of his policy of stressing similarities, he does not discuss the conflict between the two points of view. He gives the following quotation from Koffka:

40. E. L. Thorndike, Educational Psychology, (Briefer Course), 1914, pp. 161-162.

> Historically, 'trial and error' experiments preceded 'insight' experiments, and it is these former which clamor for a law of effect or success. For I am as fully convinced as Thorndike himself that — in these cases — the success of the action performed is responsible for its being learned. I differ from Thorndike only in the interpretation of this effect of success. For Thorndike, success, i.e., the pleasure of attaining the goal, stamps in a previously existing 'connection.' In my theory success transforms a process in such a way as to give it a new 'meaning,' i.e., a new role in its total goal-directed activity.[41]

Again, the practical consequences of a theory based on the principle of stamping in previously existing connections are in direct conflict with those of goal-directed activity as Koffka has described it. The difference between connectionism and field theory with respect to possible modification of responses makes the similarities which McConnell has stated (Points four and six, in particular) less apparent than is claimed. The difference is of considerable significance for a theory of learning.

The remaining three points of similarity are:

> 7. Learning is Essentially Complete (Except Perhaps for Attaining Greater Precision or Reaching a Given Level of Performance) When the Individual Has Clearly Perceived the Essential Relationships in the Situation and Has Mastered the Fundamental Principle Involved in the Concrete Problem.

41. T. R. McConnell, op. cit., p. 269.

8. The Transfer of Learning from One Situation to Another Is Roughly Proportional to the Degree to Which the Situations are Similar in Structure or Meaning.
9. Discrimination, As Well As Generalization, Is an Essential Aspect of Effective Learning.[42].

McConnell discusses these remaining points in much the same fashion as already indicated. He disregards, for the purpose of his synthesis, the important differences involved in the two basic explanations. He disregards the issue as to whether behavior is determined by conditions within the system such as changes in synapses, or whether behavior is determined by the properties of the field within which the behavior occurs. He apparently recognizes that conditioning and connectionism belong more or less together in their difference from field theory, since his discussion of similarities generally relates field theory to either one or both of the others.

The problem of differences is dealt with in the section on "How Differences in Learning Theory Have Arisen." McConnell uses the following outline in dealing with this problem; suggesting that differences have arisen because of:

1. Effect of Different Kinds of Tasks to Be Learned.
(a) Differences in Amount of Discovery of Correct Response,
(b) Differences in Difficulty of the Task.
(c) Differences in Degree of Organization in Material to be Learned.

42. Ibid, pp. 272-277.

2. Effect of Ascribing Causal Significance to Descriptive Terms.
3. Effect of Emphasis on Certain Features of Learning to the Exclusion of Others.
(a) Emphasis on 'Wholes' or 'Parts.'
(b) Emphasis on Differentiation or Integration.
(c) Emphasis on the Present Situation or on Past Experience.
(d) Emphasis on Intellectual or Emotional Factors.[43].

In his discussion of the first source of differences, McConnell develops the assumption that there is more than one type of learning implied by the data. He assumes that each of the three subdivisions represents a continuum and that research on learning material found at one end requires principles different from that on learning material at the other end. He states that,

> Learning situations, for example, differ in the extent to which the subjects must <u>discover</u> the correct response.[44].
> Closely related to the amount of discovery necessary in learning is the difficulty of the task, which is another condition that determines, in part, the characteristic features of learning.[45].
> The dependence of the learning process upon the nature of the situation can be illustrated in terms of another continuum. The tasks to be learned may vary from those which possess very little structure to those which are highly organized.[46].

43. Ibid, pp. 243-254.
44. Ibid, p. 243.
45. Ibid, p. 245.
46. Ibid, p. 246.

McConnell recognizes that these three factors may be related but apparently does not consider the possibility that they do not represent independent continua. The degree of organization in the material to be learned could be the same factor which will produce the variation in the amount of discovery required and the variation in the difficulty of the task. Nor has there been given yet any reason to assume that different principles of learning are required to explain these variations, except for the fact, perhaps, that complete agreement among the authorities on this point does not yet exist. McConnell definitely makes such an assumption. He writes,

> This kind of analysis of the learning process has led certain psychologists to conclude that there may be several kinds of learning, each of which has its own set of principles. Tolman, in fact, has listed as many as seven varieties of learning with their related "laws." However, instead of positing many discrete kinds of learning, it may be more useful to suppose that principles of learning themselves constitute a kind of continuum. Certain principles may suffice to explain single forms of conditioning in which one stimulus is substituted for another in evoking a response..... In other forms of learning, usually called instrumental conditioning, the experimenter waits until the appropiate response occurs for one reason or another, and then reinforces it with a reward....Finally one reaches learning activities in which elimination, selection, and organization of responses become the characteristic features, while mental sets, anticipations, goals, and purposes, often expressed in verbal form, add further complexities.[47]

47. Ibid, p. 255.

He continues and gives the reason for his assumption of a continuum of learning principles,

> All of these forms of learning occur in human beings. All of them occur in both children and adults. Furthermore, it is difficult to separate even such a complex process as problem solving or reasoning entirely from the more familiar forms of conditioning. Even though one might hesitate to explain problem solving entirely in conditioning terms, he would nevertheless recognize the phenomena of conditioning in some phases of the process. But with the present state of experimental knowledge, it scarcely seems wise, even to some of those most closely associated with conditioned-response psychology, to try to reduce complex forms of learning to known principles of conditioning. .... This probably means that for the time being we cannot reduce all cases of learning to a very few principles (such as the known principles of conditioning or the present rubrics of 'insight psychology') even though that ultimately may be possible, but must retain a fairly extensive set of principles to cover a wide variety of learning situations.[48]

McConnell apparently rejects the possibility of explaining learning entirely in conditioning terms because it does not seem wise to the experts to try to reduce complex forms of learning to known principles of conditioning. He rejects the possibility of explaining learning entirely in terms of field theory because he assumes that phenomena of conditioning are present in all phases of learning, including problem solving. McConnell apparently believes

48. Ibid, p. 255-256.

that the differences which do exist will not produce important conflict if principles of learning are arranged along a continuum. At one end of the continuum he places principles which "may suffice to explain single forms of conditioning," and, at the other end, he places principles required to explain "learning activities in which elimination, selection, and organization of responses become the characteristic feature, ..." In this sense he considers conditioning principles and field theory principles as complementary to each other, the one set explaining what the other will not.

In McConnell's discussion of the source of differences in learning theories there is no mention made of the effect which the basic assumptions of psychologists may have had. This is a grave omission. If one performs an experiment under the assumption, tacit or otherwise, that behavior can be explained entirely or primarily in terms of a condition of the synapses, one is likely to interpret his results differently from another who proceeds under an opposite assumption. Basic assumptions may be the greatest single source of differences among psychological theories of learning. The early conflicts in psychology have been shown to be a direct outgrowth of opposing assumptions regarding the nature of ultimate reality. The present-day conflicts which McConnell presumes to reconcile may still be traceable to the same or similar differences in basic assumptions.

It is probable that McConnell would agree with the present analysis of his position. He has stated his proposals as tentative, admitting that they do not completely reconcile all known points of conflict. He believes, however, that principles derived from two historically opposite points of view are required, for the time being at least, to explain adequately all learning phenomena. He looks forward to more complete reconciliation. In view of this outlook, a later presentation of learning theory by McConnell will next be analyzed to determine whether he has seen fit to introduce significant changes.

B. Educational Psychology by Arthur I. Gates, Arthur T. Jersild, T. R. McConnell, and Robert C. Challman.

This recent (1942) text in educational psychology began as a revision of Gates' earlier book, "Psychology for Students of Education." However, the final manuscript is "almost wholly new." The four authors collaborated on the text, working as a team rather than as independent writers.

> Each section went the rounds of all authors for intensive critical review and was rewritten or revised, reviewed and revised again -- in some cases several times. ... As a result of this teamwork, the material finally printed is appreciably different from and, we believe, much more sound and useful than the text which any one of us would have produced alone.[49]

49. Arthur I. Gates, et. al, Educational Psychology, p. vii.

Each of the four authors was responsible for the material in the field in which he had done intensive work -- Jersild for chapters two through six which deal chiefly with child development; Gates for the chapters which deal with intelligence, aptitudes, measurements, and methods of diagnosis; Challman for the general field of mental hygiene both for the school child and the teacher; and McConnell for the problems of learning, with implications for teaching and organization of school curriculum. The present study will be limited primarily to the section for which McConnell was responsible. However, his statements will be taken as representing the present position of each of the other three authors. It is stated in the introduction that the views of the authors "on all important matters were essentially in agreement."[50].

The attitude of the authors toward the problem of reconciliation of learning theories is much the same as that of the committee for the 41st Yearbook. They express it thus,

> First, each viewed the various systems or schools as merely varieties of expression of general hypothesis and not as rival cults one of which must be accepted once and for all and defanded to the death. Second, they feel that, as far as the professional applications are concerned, the differences between the schools are not very clear or very great.[51].

50. Ibid, p. 12.
51. Ibid, p. 12.

They cite as a reason for this attitude the work of the committee for the 41st Yearbook and of McConnell in particular. To quote:

> That the differences either in theoretical or practical implications of the several systems have been vastly exaggerated by the extremists was illustrated very well when a group of psychologists and educational psychologists under the chairmanship of one of the authors of this book, Dr. McConnell, worked together for more than a year in an attempt to arrive at the real similarities and differences in theories of learning. Insofar as the important professional applications were concerned, the more thoroughly the rival systems were examined the greater became the similarities and the less the differences.[52].

Thus, it is evident that differences which exist are regarded by the authors as relatively unimportant for the purposes of this particular text. This again is not a denial of the existence of such differences but rather that the differences are presumed to have no important effect upon practical applications. In the introduction the authors state that this attitude toward differences might seem to some "to result in an un-systematic treatment of the subject. We believe, however, that it is not un-systematic; it is merely nonsectarian. This book does not ardently espouse any one system of beliefs."[53].

52. Ibid, p. 12.
53. Ibid, p. 13.

McConnell writes seven chapters on problems related to learning. Two deal with the general nature of learning; two with principles of guidance in learning; and one each on the topics of development of meanings, reasoning and problem solving, and transfer of training. It is evident that McConnell still believes that it may be useful to assume a continuum of learning principles. He refers to his work for the 41st Yearbook and includes a description of an amount-of-discovery continuum which seems to imply use of both conditioning and field-theory principles. He writes,

> ... Actually, as we have pointed out previously, learning situations differ greatly in the amount of discovery which is necessary. We may think of these differences as being arranged along a continuum. At one end of the scale we would locate what is known as rote learning, one example of which is the memorization of a list of nonsense syllables. Another example is the traditional experiment on conditioning, in which a certain situation is connected with a certain response, not because of any intrinsic relationship between the two, but merely because the two occur together. ....
>
> Farther along the scale are the learning activities in which the teacher explains the reasons for a conclusion with the purpose, not of having the pupil discover them entirely by himself, but of having him understand the relationships which are presented. ...
>
> At the other extreme on the discovery scale are those situations in which the individual, though perhaps given certain leads or cues, must find the solution for himself. ...[54].

54. Ibid, pp. 467-468.

This is an elaboration of his proposals made in the 41st Yearbook, and no revision is indicated.

However, McConnell seems to place major dependence upon principles which are related to an application of field theory. In discussing the importance of relationships he states that "Relatedness has become the central concept in the psychology of learning."[55]. With regard to reflective thinking he writes, "The movement to increase this kind of educational activity is one of the most important changes in modern schools."[56]. He explains the reason for this emphasis as follows:

> In understanding human learning, it is more instructive to discover what happens when the individual attacks a rather complicated situation than when he memorizes a list of nonsense-syllables, which is often called rote learning. In the former case, the critical problems have to do with the discovery or appearance of the correct responses, the selection of the appropiate reactions and the elimination of the incorrect ones, and the organization and fixation of the adequate reaction pattern.[57].

Or, in a later statement:

> There may be some things that *we* have to learn almost by rote. But the school should hold such tasks to the absolute minimum and place its emphasis upon

55. Ibid, p. 340.
56. Ibid, p. 470.
57. Ibid, p. 324.

> rational learning. Education should call for the exercise of intelligence. Instruction should lead the child to understand; practice for the development of precision in response must wait upon adequate insight into the task or performance as a whole. The school must encourage active discovery rather than the habituation of authoritatively identified connections.[58]

In the latter statement McConnell separates the development of precision from the development of insight in much the same fashion as he expressed it in the Yearbook. He indicates, however, that the principles of learning which he assumes necessary to explain the development of precision have relatively few useful applications, in the classroom at least. He maintains this emphasis when he applies his principles of learning to the development of skills. He writes,

> There is a popular conception that an act of skill should be analyzed into its elements and part movements, and that each of these segments should be learned singly. For example, in swimming the learner may grasp the edge of the tank and practice singly some part or the whole of the leg movement; ... The theoretical basis of such formal exercise is the notion that to master the whole one must master the parts, that if one learns to do singly all of the elemental acts in a complex function, putting the single acts together will be relatively easy. This theory is quite erroneous. Learning to do the parts singly is by no means learning to do the whole.[59]

58. Ibid, p. 334-335.
59. Ibid, p. 355-356.

He justifies the isolation of a particular aspect of a performance for specific practice, but only after the part has been established in its relation to the whole. He continues the previous discussion:

> We should not begin with elaborate formal exercise of the elements or make them a large part of the course of training but should utilize them as strictly preventive measures where difficulty is beginning to appear or as remedial measures where a particular defect or deficiency is apparent. When thus singled out for specific treatment, a particular aspect of a total performance has a significance and character it could not have as an isolated segment practiced without respect to its membership relations.[60]

This same separation is implied in his treatment of the learning of arithmetic combinations. We find:

> Making gross comparisons of "more," "less," "equal;" manipulating and counting real objects; and practicing the apprehension of concrete numbers in the form of dominoes or other geometric pattern are important background for arithmetic readiness. Habituation of the addition, subtraction, multiplication, and division combinations is a final process preceded by progressively more mature forms of solution.[61]

At this point McConnell does not give any reasons for assuming that habituation of number combinations or the use of remedial exercises in skill development require a

60. Ibid, p. 356.
61. Ibid, p. 307.

process of learning different from that used to establish a sense of relationships. This is, doubtless, the idea to which he refers in the Yearbook in the statement that the phenomenon of conditioning is apparent in some phases of complex learning. On that occasion the weight of expert opinion apparently convinced him of the necessity for such a position and nothing since that time has appeared to require a change. The emphasis which he places upon the development of meanings prior to any process of habituation makes his position different in that degree from traditional conditioning or connectionism. But he makes it clear that the process of habituation which he describes is closely related to the traditional concept. Some of his terminology implies the assumptions common to early Thorndikian psychology.

He speaks, for example, of "fixed responses" in such a way as to imply a one-to-one correspondence between stimulus and response. In a discussion of the discovery of correct and incorrect responses he writes,

> Although it is important to detect and eliminate inefficient or incorrect responses, it is even more essential to disclose the correct reactions and reveal their relations to other phases of the performance and to the goal. Above almost everything else, knowledge that progress in the right direction is being made is a stimulant to further successes. In this work, as indeed at all stages of learning, the instructor or coach should constantly be on the alert for the recurrence of old or the appearance of new errors. They should be detected before

> they become fixed, and the proper response suggested. When an error is once eliminated, it should never be mentioned again. Emphasis should, then, in general be placed on the correct reaction; but the incorrect response should never be ignored.[62]

McConnell does not discuss why an erroneous response should not be mentioned following its elimination. Such a suggestion imples a belief that mention of the error would evoke an automatic chain of responses which had previously been fixed, and that recurrence of this chain of responses would delay the weakening process. If his concept of learning involved only the sensing of relationships, it would be important that a learner should comprehend relationships, not just those which a teacher has labelled "correct responses." Reactions which impede progress toward a goal can not be grasped adequately, so that later they will be avoided consistently, by having a learner ignore them.

Thus, it appears that McConnell's position with regard to a theory of learning is basically the same in both of the texts reviewed. In the Yearbook he suggests the advisability of placing principles of learning along a continuum. Principles at either end of the continuum are apparently derived from basically different theoretical positions but McConnell believes that conflict will be reduced if the principles are considered as complementary. That is,

62. Ibid, p. 359.

each should be limited to the phase of learning for which it appears to be most useful. In the textbook he elaborates upon the practical application of these principles. Since, for a classroom, he would hold to the minimum tasks which involve rote learning it seems that he would minimize the use of conditioning principles. However, he implies that such principles are required for certain purposes (habituation of arithmetic combinations) and he makes it clear that for him these principles belong within the framework of traditional concepts of stimulus-response psychology.

Such an approach to the problem of reconciliation is based on the assumptions, as McConnell indicates, that (a) some conditioning phenomena are apparent in complex learning situations, and (b) that conditioning principles are, by themselves, inadequate to explain complex learning. As indicated in the 41st Yearbook, Gates takes the position that connectionism is not dependent upon any assumption which conflicts with those of field theory. Data relative to Gates' position and to the two assumptions given above, on which McConnell bases his proposals, will be considered in Chapter Five.

It is important also to consider proposals, other than those of McConnell, which purport to offer some solution to the problem of developing a theory of learning. For this reason a representative selection of contemporary texts in methodology will be considered next.

# CHAPTER IV

## THEORIES OF LEARNING FROM CONTEMPORARY TEXTS ON METHODOLOGY

### A. A Theory of Learning as Proposed by Thomas M. Risk.

"Principles and Practices of Teaching in the Secondary Schools" by Thomas M. Risk is designed primarily as a text-book for students in training. The author has analyzed the methods, devices, and techniques which have been effective in handling classroom problems, and has developed important principles which apply to such problems.[1] The book is organized into five units, as follows:

> Unit I: Some Fundamental Problems of Teaching.
> Unit II: Learning Activities and the Attainment of Desired Outcomes.
> Unit III: The Organization of Courses of Instruction and Units.
> Unit IV: Methods of Planning and Organizing Classroom Activities.
> Unit V: Stimulating and Directing Classroom Activities and Measuring Outcomes.

Most of the data for the present study are taken from the first two units which deal specifically with principles of learning.

The third chapter of the first unit takes up the question of fundamental concepts. Risk presents this discussion

1. Thomas M. Risk, Principles and Practices of Teaching in the Secondary Schools, p. v.

because he believes that:

> The prospective teacher often has a smattering of psychological theories of learning or a very biased interpretation of learning, either of which frequently precludes respectful consideration of the nature of learning experiences. Often the student has failed in his study of psychology to see its application to classroom problems. In this unit various psychological interpretations of learning are discussed to show their relation to practical classroom problems and to aid the prospective teacher in understanding the nature of the learning activity with which he must deal.[2].

He includes the interpretations of Thorndike, of conditioned-reflex psychologists, and of Gestaltists. He includes also a brief presentation of the related problems regarding assumptions on the nature of mind and matter. He thus recognizes the conflicts which have existed among learning theories and their relations to the broader philosophical view.

However, Risk does not believe that any of the different interpretations of learning is adequate, taken by itself. He writes in the summary of the third chapter as follows:

> The different theoretical interpretations of learning each emphasize different aspects of learning and each point of view has evidence strongly supporting its assumptions... It would appear that a delicate, sensitive organism needs to be handled with more care than a purely mechanical contrivance and that learning

2. Ibid, p. 2.

> activities would be more effective if we would treat the individual as an intelligent, purposing organism governed by insight gained through experience.... ... Altogether, these facts suggest why learning cannot be satisfactorily explained wholly in terms of "conditioned reflexes," "organismic laws," or other concepts borrowed from the physical and biological sciences. In choosing learning activities, the teacher must ever keep in mind that such activities are personal experiences, and that they involve purpose and meaning, recollection and foresight.[3].

His position is that each of the principles derived from different points of view is applicable to a particular aspect of learning. In line with this belief, the general plan for the text as a whole is to present a wide variety of ideas and suggestions, each of which might be useful in a particular situation.

The actual choice of a given principle for use in a given situation will be left largely to an individual teacher's judgment. Risk states this on three different occasions, as follows:

> Pupil activites should be chosen in accordance with the psychology of learning processes involved or the principles of learning as discovered by scientific experimentation, or, in its absence, determined by expert opinion or generally accepted good practice.[4].

3. Ibid, pp. 76-77.
4. Ibid, p. 58.

> The important thing in learning is to observe what activities or experiences are effective in learning under different conditions. Such objective evidence will help the teacher to choose wisely the learning exercises or activities in some future learning situation.[5]

> Since psychologists fail to agree on the fundamental laws of learning teachers must be guided in their practice by the objective evidence of effective experience in learning.[6]

Risk's method of dealing with the conflicting points of view implies separation of fact from theory in such a way that facts are assumed to have a quality of objectivity which makes them independent of the interpretations placed upon them. Also, wherein facts have not yet been discovered, expert opinion should be accepted. If theories are in conflict, objective evidence can be secured by observation.

This implied separation between fact and theory is noticeable also in the following references. For example, during Risk's discussion of the problem of transfer of training he uses the phrase, "Experimental evidence bears out the conclusion that regardless of the theoretical explanations of transfer, ..."[7].

5. Ibid, p. 59.
6. Ibid, p. 76.
7. Ibid, p. 99. "Experimental evidence bears out the conclusion that regardless of the theoretical explanations of transfer, pupils will be able to solve new problems or situations according to their ability to analyze relationships and recognize the application of previously acquired knowledge and abilities (including methods of work or methods of attack), but the ability to do this will depend in large measure upon previous experience in applying their knowledge and abilities in similar situations."

(Complete sentence given in footnotes.) This is, in effect, an assertion that conclusions can be formulated by consideration of experimental data (facts) alone, without reference to theoretical assumptions or implications. Or again in his discussion of the problem of the relation of the nervous system to learning he writes,

> Whatever theory of learning may be propounded to account for the learning process, whether that of behaviorist, that associationist, or the Gestaltist, the fact remains that the nervous system must function through its reactions, which we commonly interpret in terms of experience.[8]

Risk's position on the problem of transfer of training or the relation of the nervous system to learning is not the issue at this point. It is instead the relationship between fact and theory which he implies by his terminology. Repeated references to facts which are apparently presumed to be independent of theory is characteristic of the thinking which follows from the assumption that objective truth exists independent of experience or interpretation. Risk's position on this point will be followed further before taking up the exact nature of the learning principles which he suggests.

8. Ibid, p. 75.

During his discussion of the various assumptions which have been proposed regarding the mind-body problem he mentions the concepts of materialism, idealism, psycho-physical parallelism, and others. He apparently does not adopt any of the points of view as stated, but takes the attitude that scientific investigation cannot, at present, settle these problems.[9] Furthermore, he is not sure that it makes much difference what theory is adopted. He states,

> What difference does it make what theory is held? For all practical purposes, perhaps little. But a study of the facts necessary to determine the nature and validity of each theory, emphasizes the important role that physical experiences play in mental activity, whatever it may be. Assuming that ideas, meaning, concepts, facts, principles, etc., are mental in nature, we must admit that they are very vitally related to physical experiences. ...
>
> The educational implications are clear. All significant learning depends upon purposeful and meaningful experiences which rest upon physical experiences as a fundamental correlate.[10]

In later discussions which involve some phase of this problem he makes no clear statement of the assumptions he uses as to the relationship between sense impressions and the meanings which result. He says,

> The teacher must remember that all knowledge rests primarily, either directly or indirectly, upon fundamental sense experience.[11]

9. Ibid, p. 64.
10. Ibid, p. 65.
11. Ibid, p. 75.

However, this does not indicate definitely whether Risk believes that knowledge will be built up automatically from repetitions of sense impressions or that knowledge develops only as an individual organizes his sense impressions with regard to his goals and purposes. The nearest Risk comes to taking a definite position on this issue is by apparent endorsement of a quotation from another source. He does not voice objection to the implications of the statement and, to this extent, it may indicate his own position. In discussing the relation of several factors upon which the efficiency of the learning activities depends, he mentions the functioning of the special sense organs and their importance. He states,

> The importance of the proper functioning of the sense organs and their relation to attention is well illustrated by the following quotation:
>
> Objects and ideas should be presented through as many different senses as possible and should be carefully associated in all their relationships. Associative activity is a synthetic process by means of which the various sensational experiences are unified. A child sees a snowball for the first time. Through his vision he sees that it is white. Through his touch he sees that it is smooth and fairly hard. His temperature sense records an intense cold. It is tasteless and without odor. His muscle sense shows it to be heavy compared with cotton. Through the compounding of various sensations he gains a percept of roundness and an estimate of

> size. Holding it for some time he expe-
> iences a painful ache. When these ex-
> periences are all associated, the child
> now has a fairly adequate idea of a snow-
> ball.[12].

This concept of the relation of sense impressions to experience, as given in the above quotation, is in harmony with the emphasis which Risk places upon the objectivity of fact or of observation as opposed to theory or interpretation. But, as indicated previously, he does not hold that the principles of learning which are derived from such realistic assumptions are entirely adequate. He includes considerable discussion of reflective thinking and problem solving in relation to securing knowledge and understandings, and states that there is no better way to teach independence and initiative than by use of problem solving.[13]. He defines a "problem-solving teaching procedure as a process of raising a perplexity, difficulty, or problem in the minds of pupils in such a way as to stimulate purposeful, reflective thinking in arriving at a rational solution of the perplexity, difficulty, or problem."[14]. In the introductory chapter he says,

> Fortunately education has swung to
> an emphasis of the importance of the
> individual as a learning, adjusting,
> purposing organism, thus emphasizing the
> development of personality as "intelli-
> gently controlled behavior."[15].

12. Ibid, p. 167-168. (Quotation from C. E. Benson, et al, Psychology for Teachers, p. 237.)
13. Ibid, p. 453.
14. Ibid, p. 452.
15. Ibid, p. 4.

In contrast to this, those sections of the text which deal with phases of learning other than that of problem solving imply assumptions which have been related historically to conditioned-response psychology. For example, in the section wherein he discusses memorized associations, he says,

> Memorization is a process of repetition by which certain associations (including items of information) are automatized for ready recall just as a matter of convenience or efficiency. It is not a means of learning meanings or getting understandings, although pupils may interpret at the same time they are memorizing.[16]

The process of repetition which he considers necessary follows Thorndike's early definition of learning. He states, with regard to drill,

> To be effective, drill must be definitely provided for and definitely directed. This means that the law of specific habit formation must be followed explicitly.[17]

In this type of learning Risk is concerned with the fixation of a response; not with the development of new meanings or grasp of relationships. He believes that the development of understanding should precede the process of

16. Ibid, p. 199.
17. Ibid, p. 386.

fixation, and that two separate processes are involved. He writes,

> For example, it may be a valuable aid to a pupil to memorize several formulae for ready recall, but to learn to understand them and use them is quite a different learning process. Psychologically, the latter should come first; then memorization of them will help a pupil to be a faster and more efficient worker.[18]

Risk assumes that the principle of sensing relationships is inadequate as an explanation of what takes place during learning of formulae for ready recall. He implies that such a principle is required, however, to explain the process of understanding and using them.

In line with this belief Risk proposes five classes of learning activities. These are, in part, as follows:

> 1. Knowledge and understanding -- reflective thinking-- perceptual experience and problem-solving.
> 2. Specific motor abilities -- practice in using motor co-ordinations.
> 3. General adaptive abilities -- practice in applying understanding in working specialized problems -- problem solving.
> 4. Memorized associations -- repetition of associations -- memorization.
> 5. Emotionalized outcomes ....[19]

18. Ibid, p. 386.
19. Ibid, p. 155.

He would apply reflective thinking and problem solving methods to the activities which fall under the first and third categories. But he does not accept these methods as having particular value in the activities suggested under the other three. This is especially true in the fourth category wherein he applies exclusively the definition and principles of memorization which have just been reviewed.

These principles of memorization are, for Risk, based upon a tacit assumption that certain aspects of behavior can be explained only on the basis of fixed neural connections.[1] This is evident in an analysis of three different phases of the text. First, it has been shown by the use which he makes of repetition. Repetition which does not involve development of new meanings can have no function other than to build up or strengthen some sort of pathway through the nervous structure so as to enable a specific stimulus to evoke a specific response. Second, it has been shown indirectly by the assumptions which Risk implies with regard to the independence of reality from experience. He has apparently adopted the position that some knowledge can be built up by repeated sense impressions; that ideas of physical objects result from a combination of nerve impulses set in motion by the stimulation of receptor organs. Third, it is shown by the assumptions which he makes regarding the original nature of man. He states,

> Our inherited conduct-controls are what they are because we are human beings. The child brings into the world -- inherits, we say -- certain sets of reflex mechanisms ready to act. From then on his growth and development exhibit tendencies to certain types of activity or behavior.[20].

> The best interpretation of observable activities of children seems to be that there are definite reflex mechanisms ready to function at birth, and that there are certain types of unlearned activity that may be termed instinctive and emotional reactions.[21].

> Apparently similar activities have back of them a fundamental drive, and consequently, similar sets of stimuli may be expected to set off the related sets of activities, except as conditioned by learning.[22].

By this assumption of inherited reflex mechanisms which are set off by appropiate stimuli, Risk has consistently adopted a realistic view for his explanation of these phases of behavior.

For an explanation of learning as a whole the foregoing represents a definitely dualistic position. Both Risk and McConnell place such activities as rote learning and the attainment of precision in one category, and the development of understandings based on a sense of relationships in another. They do not oppose the concept of insight as offering an explanation for certain phases of

20. Ibid, p. 82.
21. Ibid, p. 84.
22. Ibid, p. 84.

learning. They believe that this concept is not adequate in all situations. Risk goes farther than McConnell however, in the degree to which he adopts assumptions related to traditional conditioning psychology. His only procedure, when conflicts arise, is to rely upon direct experience which he regards as a source of objective data. To do this is itself evidence, of course, not of neutrality but of adoption of a realistic outlook.

B. A Theory of Learning as Proposed by William H. Burton.

Data from the text "The Guidance of Learning Activities" by William H. Burton were considered relevant to the present study since this publication represents another contemporary attempt to develop a set of general principles of teaching based upon principles of learning. Part One of the text consists of eight chapters on "The Principles of Learning." The remainder of the text is devoted to application of these principles to two procedures which are in use in the schools today. These procedures are the "traditional assign-study-recite-test procedure, or the more recently developed unitary organization."[23]. Burton does not agree with what he regards as common practice of assuming that an either-or choice between procedures is required. His text is an effort to develop "for each of

23. William H. Burton, The Guidance of Learning Activities, p. vii.

the two procedures the most adequate treatment that the author could devise."[24]. He believes that traditional methods have their place in the classroom and states that,

> The emphasis here is first upon understanding the proper use of traditional methods, and second upon the possibility and necessity of improvement. Traditional methods as commonly operated in secondary schools are susceptible to literally enormous improvement.[25].

Burton's acceptance of the usefulness of various theories of learning parallels his reference to traditional and new methods of teaching procedure. He states,

> The educational literature contains several sets of "laws" of learning, or principles of learning, or of so-called general methods of learning and teaching. Each of these is based upon a psychological interpretation of what is known about learning, both the little that is known about inner processes, and the considerable amount that is known about observable, overt activities which accompany learning.
>
> The various schools of psychological thought, however, are not mutually exclusive, nor should they be set so sharply in opposition to each other as some writers set them...Each makes a contribution to the total field.[26].

With regard to accepting various contributions he states that,

24. Ibid, p. vii.
25. Ibid, p. viii.
26. Ibid, p. 211.

> We are not, however, merely to "take the best from each school" and combine them. This type of eclecticism is likely to result in a hodgepodge. The contributions from the various schools must be parts of an emerging and increasingly coherent systematic core of principle.[27].

He does not assume that complete reconciliation of learning theories has yet been effected. After discussing the work of the committee for the 41st Yearbook he writes, "Progress in research and interpretation will doubtless further reduce differences and bring eventual unification."[28].

Burton's disapproval of eclecticism and his statement in the preface to the effect that he has made "every effort to avoid inconsistencies and errors of fact,"[29]. indicates that this text may represent a different approach to the present problem from that which has been presented by either McConnell or Risk. He has set out to effect some type of reconciliation between traditional and modern procedures and to base these procedures upon an increasingly coherent, systematic core of learning principles.

The criteria which Burton suggests for selection of principles of learning are as follows:

27. Ibid, p. 148.
28. Ibid, p. 148.
29. Ibid, p. ix.

> Principles of learning offered as a basis for teaching must
> a. rest upon a valid theory of knowledge,
> b. rest upon facts concerning the nature of the learning activity,
> c. rest upon facts concerning the nature and development of individuals,
> d. square with the aims of our democratic society, and
> e. square with valid evidence of successful learning.[30]

Burton discusses at length the contrast between absolutistic and relativistic conceptions with respect to a theory of knowledge. He distinguishes between persistent truths and absolute truths. He defines persistent truths as those meanings and values by which civilization lives. They have been derived from "real life situations so often and over so long a period of time that they are accepted as persistent truths."[31]. He points out that an assumption of the existence of absolute truths has been misleading in the past and that "to deny certain statements the label eternal or absolute will not impair them if they should ever turn out to be absolute -- if we could ever find out!"[32]. For this reason he does not consider it advisable to assume the existence of absolute truths.

30. Ibid, p. 62.
31. Ibid, p. 73.
32. Ibid, p. 74.

In this respect Burton closely follows the assumptions of relativistic philosophy. However, he names his position as the "so-called pragmatic, more properly the empirical"[33]. theory of the origin of knowledge. This confuses the issue because the term pragmatic in philosophy refers to a way of thinking which is in opposition to an empirical conception of ultimate reality. It is difficult to determine the exact meaning which Burton intends to convey by the use of these conflicting terms. He uses the word empirical in the following context:

> The first knowledge derived by anyone clearly comes empirically from direct experience. The vast bulk of knowledge dealing with everyday affairs, possessed by individuals and by society is equally empirical in origin.[34]

This could imply assumptions common to a Realistic philosophy, yet Burton considers his position as opposite to that held by Breed in the book, "Education and the New Realism."[35]. He believes also that his theory of knowledge will be unacceptable to some religious leaders because of the omission of revelation as a source of knowledge.[36]. Thus, although he claims opposition to both Realism and Idealism his position cannot be taken as representing a completely relativistic approach because of the emphasis which he has placed upon the empirical origin of knowledge.

33. Ibid, p. 70, footnote.
34. Ibid, p. 70, footnote.
35. Ibid, p. 70, footnote.
36. Ibid, p. 74, footnote.

Throughout the text Burton refers frequently to the activities which he considers essential to learning. In the preface he describes the term "learning process" thus:

> The term "learning process" refers always to the outward, observable, and describable activities through which pupils go when engaged in learning. The term does not refer to the inner learning processes which are the object of study by psychologists. The term learning activity has been used in place of "process" whenever possible.[37]

This emphasis upon activity is apparent in his presentation of an illustration which describes a high-school boy in a learning-to-bat situation. Among the important aspects of learning which he summarizes in his discussion of this illustration is the following:

> 4. The learning process consisted chiefly of doing the actual thing to be learned, but a multitude of varied, natural learning activities also entered to contribute to the central learning activity. Amplified later this point becomes a basic principle: we learn what we do, and we do what we learn. The boy learned to bat by batting, and not by reading or talking about batting.[38]

In a later reference regarding the same illustration he writes,

> The boy learned what he learned through reacting, through doing, through undergoing the things he learned. This process of learning by doing, reacting, undergoing is called experiencing.

37. Ibid, p. ix.
38. Ibid, p. 11.

> Experiencing is the actual living through of actual situations and of reacting variously to the several aspects of that situation. Experiencing includes whatever one does or undergoes which results in changed meanings, attitudes, skills, changed behavior of any type.[39].

Still another example of the manner in which Burton related activity to learning is found in an illustration on the method by which a city child learns that milk comes from cows. He states that a child who has been merely told that milk comes from cows still does not know this fact in the strict sense of the word. The child may agree to and repeat the statement, but still lacks knowledge. He writes,

> The child will <u>know</u> what a cow looks like and how milk is secured only by experiencing; in this case by seeing a cow being milked...Being <u>told</u> that milk comes from cows does not affect behavior because the children did not <u>know</u> what that meant. They merely <u>agreed</u> or <u>accepted</u> the <u>verbal</u> statement. The previous chapter has already dealt with the futility of verbalism. Knowledge, attitudes, or appreciations, special abilities, and skills all come from experience.[40].

This position appears to compare closely with that of the "activity school" which emphasizes the idea that we learn by doing; that the doing automatically produces learning. However, Burton indicates later that he is not advocating the extreme application of this view. He differentiates between the reactions which result from

39. Ibid, p. 61-62.
40. Ibid, p. 65.

experience and a possible and desirable subsequent analysis of that experience. He states,

> The reactions of the experiencer are vital. The analysis of experience is far more significant than any amount of simple repetitive experience. Many persons who claim "twenty years of experience" have often actually had but one year of experience -- but they repeated it twenty times ... To be valid, personal experience must be subjected to critical, logical analysis, checked aginst the collective experience of thousands of persons, subjected to check through controlled experimentation and by instruments of precision.[41]

The relation of this analysis to the complete learning situation can be illustrated by another reference which Burton makes to the boy-learning-to-bat situation. He describes it as follows,

> The chief learning activity in this case was going through the act of batting; however, vital subsidiary processes entered ..... The subtle and complex processes of reflective thought entered significantly ..... Investigation and the learner's own questions revealed that he pondered the factors. To take time to think is a valuable learning activity. As he walked home, milked the cows, or did other things not requiring his full attention, he analyzed suggestions and directions. He planned mentally how to apply them. He rejected some suggestions, modified others, and evolved some new ideas of his own. He utilized all the range of mental skills in learning to bat: sharp definition of difficulty, analysis, comparison,

41. Ibid, 77-78.

> abstraction, anticipatory planning, guessing what might happen, and many others. The boy's past experience was drawn upon repeatedly.[42]

Thus according to Burton, reflective thinking is one of several significant subsidiary activities on learning a skill such as batting. The various activities in this learning situation were unified around one central purpose, to learn to bat in order to get on the team."[43]

This implied distinction between experience as awareness of sense impression or reactions and experience as a process of critically analyzing the relationships so as to insure progress toward a goal is different from a strict application of relativistic concepts. The first emphasis implies a mechanistic stimulus-response sequence to account for learning. Burton apparently rejects this concept as offering a complete explanation and includes reflective thinking, analysis, or constant checking of the results against similar experiences of others, as an addition necessary to describe adequately a complete learning process. He lays claim, by use of the term pragmatic, to a relativistic theory of knowledge. However, consistent application of relativistic principles would exclude emphasis, such as that indicated above, which would tend to make a mechanistic stimulus-response sequence a necessary assumption for any

42. Ibid, pp. 6-7.
43. Ibid, p. 9.

part of the learning process. The fact that he includes some relativistic principles may be the reason for his claim of divergence from a strictly realistic view.

This indication of a dualistic position is more evident in the specific principles of learning which Burton presents for acquiring skill. On the one hand, he points out the variability of a skill in the statement,

> ... skills are not precise, fixed routines to be achieved through unthinking repetition. Skill performance is inherently variable. It varies from person to person, from time to time with the same person, and from situation to situation. Skills must also be developed for use in varying situations and positions.[44]

He also discusses at considerable length the organismic concept of the nature of the learner and reviews the work of Lashley in this connection. He follows this with the statement,

> This demonstrates conclusively that the learning of specific things is not the specific property of specific neurones, but is a general function of the whole nervous system.[45]

However, his description of the two phases of learning skills is in direct conflict with the above two quotations. He gives these phases as:

44. Ibid, p. 396.
45. Ibid, p. 145.

> The integrative phase of skill learning in which meaning is developed demands varied practice which means many functional contacts and exploratory activities. The refining phase in which precision is developed demands repetitive practice. Varied practice by itself yields meaning but not proficiency, repetitive practice by itself yields efficiency but not meaning.[46]

He does not indicate how the refining phase of which he speaks can possibly be beneficial when he has previously stated that skills are not fixed routines and that learning of specific things is not the specific property of specific neurones.

The separation which Burton has indicated between development of meanings and attainment of precision is maintained throughout a list of general principles underlying practice or drill. He states that,

> 1. Practice should be only upon materials susceptible to automatization.
>
> a. Skills and arbitrary associations are perfected through practice.
>
> b. Meanings, attitudes, and appreciations should not be included in this procedure.
>
> 2. Practice must be meaningful.
>
> a. Varied contact to develop meanings should precede repetitive practice. Allow time for meanings to develop before starting practice.
>
> b. The element to be made precise should be derived from a meaningful unit; be useful in the unit; be useful in life.
>
> c. The element must be applied soon and often in real, non-practice situations.
>
> d. The attitude should be achieved and maintained that practice is a normal and needed adjunct to complete learning, not just a chore.[47]

46. Ibid, p. 397.
47. Ibid, p. 402.

The procedure for the development of meanings is regarded by Burton as different from the procedure for development of skills and arbitrary associations. The procedure for the development of precision does not yield new meanings. If new meanings are not to be expected from repetitive practice, then of what value is such practice? Exclusion of the development of new meanings in the "refining" phase of skill learning and the division which Burton has established appears to imply a tacit assumption of a stamping in process. The refining phase, as Burton describes it, can easily be taken to mean repetitive drill in the traditional Thorndikian sense. If Burton does not intend such an interpretation he should have described this phase of skill learning differently.

This issue is important for a theory of learning. Contemporary schoolroom procedure often takes the form of giving the pupils insight first and then drilling them. Such procedure might logically follow if McConnell's analysis embodies the best approach. However, this does not represent relativistic procedure, which Burton purportedly is trying to follow. One who applies relativistic principles expects additional and new meanings to be developed during the refining phase. This phase is considered as no different with respect to basic procedure from that which is employed by a learner the first time he attempts to perform an act.

The differences that exist between the first performance and additional practice on the same act might be illustrated by an analogy. When a workman turns out a candlestick on a wood lathe the first part of the work consists of shaping an odd-shaped piece of wood to the general contour of a candlestick. After this rough outline is completed the refining phase begins. This consists of sharpening the essential design features of the candlestick and includes sanding and polishing the object. The relationships of the detailed features of the candlestick are still constantly changing during this process, though not as rapidly as at the first. It is, however, a series of progressive changes of relationships which are directed toward accurate representation of an object through the process of refinement of detail.

Thus a relativist differentiates between the grosser and finer aspects of skill learning. The relationships which are established at first are grosser than those established during the refining phase. However, the process of establishing relationships among elements of environment is considered as applicable to the one stage as to the other. A relativist believes that there is no need of assuming a different procedure when the changes of relationships become small. Burton implies that no change of relationships occurs during the refining phase (no new meanings appear) and in this respect his procedure is different from that of a relativist.

Burton appears to follow McConnell's proposals quite closely in his separation of the integrative and refining phase of skill learning and in his principles which he considers applicable to each. Both regard the attainment of precision as requiring a distinct set of principles for explanation of the process. McConnell, in the Yearbook, suggests that conditioning principles may be applicable for this phase of learning; Burton implies the use of similar principles. Burton's discussion of the refining phase of skill development is inconsistent with his apparent recognition of the flexibility of skill performance and acceptance of the assumption that learning of specific things is a general function of the whole nervous system.

C. A Theory of Learning as Proposed by L. Thomas Hopkins.

The text "Interaction: The Democratic Process" by L. Thomas Hopkins represents an approach to the problem of developing a theory of learning different from those which have been presented thus far. The text is not concerned primarily with a presentation of teaching methods; Hopkins develops, rather, a philosophical background for specific suggestions related to the improvement of all phases of education. He espouses a democratic philosophy for his basic pattern, as he points out in the following quotations:

> In this book the author suggests some implications of the democratic process for the improvement of living generally, but more especially for the improvement of the education of all children through the schools.[48]
>
> ... the schools face the grave responsibility of aiding the present generation to obtain a clearer, surer insight into the democratic process, a sounder, firmer belief in its value, and a much greater competence in its practice. To help educators, parents, citizens in meeting this responsibility more effectively is the chief purpose of the author of this book.[49]

Hopkins suggests implications of the democratic process for problems related to the curriculum, psychology of learning, the development of study units, development of habits and skills, measurement of outcomes, administrative practices, and teacher training.

The two chapters in the text which include Hopkins' conception of learning, and suggestions for the development of habits and skills, will be considered here. Since the primary emphasis throughout the text involves an attempt to square all proposals with a democratic philosophy, the theory of learning which is developed may indicate new suggestions for reconciliation of previous conflicts. He indicates that his theory of learning will meet the above requirements. He writes,

48. L. Thomas Hopkins, Interaction: The Democratic Process, p. 3.
49. Ibid, p. 16.

> The theory of learning must support the democratic process of cooperative interaction. It must be directed toward aiding learners, young and old, to achieve all-around growth under intelligent freedom rather than aiding children to acquire fixed knowledge selected by adults and taught under rigorous adult controls.[50]

In a discussion of the relation of philosophy to the curriculum, Hopkins[51] suggests criteria for evaluation of the effectiveness of one's thinking — evaluation of one's philosophy. These are: clarity, consistency with the facts, consistency with experience, consistency with other beliefs, utility and simplicity. If Hopkins has successfully applied these criteria to the data which he presents, his interpretations should then represent a systematic and satisfactory solution to the problem he has tackled.

The basic beliefs which Hopkins gives as characteristic of the democratic way of life can be summarized as follows:

> 1. Belief in the worth of the individual as a human being; ...
> 2. Belief that everyone has the capacity to learn how to act on thinking;
> 3. Belief that a person who must abide by decisions should have a part in making them; ...
> 4. Belief that the control and direction of democratic action lies in the situation, not outside of it; ...

50. Ibid, p. 12.
51. Ibid, p. 191 ff.

> 5. Belief that the process of living is the interactive process; ...
> 6. Belief that cultural change should be accomplished through deliberative social action rather than by methods of uncontrolled violence; ...[52].

He includes in this discussion a contrast between a philosophy of fixed ends and a relativistic philosophy as applied to social organization, theory of knowledge, theory of learning and the curriculum. In a diagrammatic presentation of the two points of view[53]. he aligns the philosophy of fixed ends with authoritarianism and with a conditioned-response psychology of learning. He aligns a democratic philosophy with "integrative learning" and an "experience" curriculum.

Hopkins uses the terms "directional process goals" to describe the goals which motivate the behavior of democratic peoples. He discusses these goals as follows:

> They are broad, flexible, but none the less definite and applicable principles which are guides to the actions of persons of all ages and at all times. Being principles, they are amenable to revision through proved experience, but they also set limits to the process in the experiences by which their validity is established. Such directional process goals are in sharp contrast to the fixed end or knowledge goals which all too frequently prevail in our school system.[54].

52. Ibid, pp. 102-103.
53. Ibid, pp. 202-203.
54. Ibid, p. 5.

The relation of experience to learning follows the relativistic conception in general, as Hopkins has presented it. He presents first the logic of the basic thinking responsible for the subject curriculum and contrasts the logic of the experience curriculum with this. In his discussion he describes the relation of experience to learning thus:

> The advocates of the experience curriculum are equally concerned over the difficulties of dealing with the changing, the unforeseen, the unexpected, or the novel aspects of life. .. ... The business of inquiry or thinking under such circumstances is to formulate a set of relations among the various disturbing aspects so as to reach some harmonious readjustment. ... The logic for such inquiry is inquiry itself. ... Thus experience becomes the center of learning, and the operational controls built through experience become the logic.
>
> In this conception of logic experience is the very stuff of learning; the novel aspects of experience are the very center around which the process of learning is built. Knowledge is built in this process. It accompanies the inquiry to resolve the disturbing situation. It does not antedate the inquiry since no previous disturbance ever had the same novel conditions. Thus the wisdom is not revealed by withdrawal and contemplation apart from the actual conditions in the situation. Neither is the wisdom revealed to a few persons to impose the result upon others. Each individual must build his logic through his own experience.[55]

55. Ibid., p. 48.

In a later reference he amplifies this relationship further as follows:

> In any experience there are two sets of conditions which must be considered. These are the internal and the external conditions. The internal conditions are everything that is in the individual, and the external conditions are everything outside of him, or in the environment. The interplay or interaction of these two sets of conditions forms a situation. Experience moves forward through a series of such situations. When an individual faces a situation, he struggles to control and direct the conditions within himself as well as those external to him, for both must be brought into accord to achieve a reasonable readjustment.[56]

Similarily, with respect to a theory of learning Hopkins presents a relativistic point of view. A conception of learning which he believes "squares well with the democratic beliefs in creative individuality"[57] appears in both chapters which deal primarily with this subject. He summarizes it in these statements:

> Learning is sometimes considered as the progressive changes which an individual makes in the logic of his experiences due to his increasingly purposeful efforts to resolve his own personal problems of living more intelligently.[58]
>
> The conditions affecting a conception of learning are not static but are

56. Ibid, p. 209.
57. Ibid, p. 140.
58. Ibid, p. 140.

> ever-changing... These conditions imply that any adequate conception of learning must be a statement of principles rather than a set of laws, a flexible viewpoint rather than a body of methods and procedures, a means of obtaining better insight into the intelligent control of human relations rather than a procedure for acquiring a few fixed knowledges and skills.[59]
>
> Under the organic conception learning is not addition at all. It is a modification of the organism in the direction of new insights or meanings, new elaboration of functions, new refinement and precision of parts. The new insights, the new functions, the new refinement of parts spring from a revision or a modfication of the old. They are not superimposed upon what is already in existence. Neither are the old and the new put together in such a form that their identity can be reconstructed at some future time. What was in existence has undergone change. This modification of the old into the new is the essence of all learning.[60]

Hopkins refers frequently to the conditioning theory of learning but consistently rejects this theory as having possibility of useful application to modern educational practices on the grounds that it does not square with the democratic philosophy. He points this out first in the section im which he gives his viewpoint for the text as a whole. He writes,

> Low level learning as conditioning or connecting stimuli and responses is present in the general culture and in laboratory research of many psychologists,

59. Ibid, p. 135.
60. Ibid, p. 155.

> but it will not suffice for the schools since it gives inadequate consideration to cooperative democratic interaction and to the building of intelligence.[61].

Later references support this same view,

> Learning through conditioned responses controlled by others is too commonplace and too inadequate for interpreting the democratic way of life.[62].
>
> Anyone who views the problem of learning intelligently will admit that some learning takes place by conditioned response, conditioned stimulus, or by connectionism. But the point at issue is not whether learning does or does not take place by these methods. The crucial problem is whether or not this is a desireable conception of learning for the schools to use in helping children to acquire the habits and skills which they, their parents, and the public think important. ...the method of conditioning so limits the interactive process that it contributes little constructive results to the integration of personality, the upbuilding of thinking, and the refinement of the logic of experience, which are so vital to all desirable learning.[63].

These references indicate that Hopkins does not undertake to reconcile possible conflicts between a conditioning theory of learning and the theory which he proposes. He merely rejects conditioning as useful for the classroom, primarily on the grounds that its principles do not square with the implications of a democratic society. In

61. Ibid, p. 12.
62. Ibid, p. 139.
63. Ibid, p. 288.

this respect his approach to the problem of formulating an adequate theory of learning is different from that of McConnell, Risk, or Burton. He has stressed the importance of including data from our ideas regarding democracy in a formulation of a theory of learning.

There is a slight indication that Hopkins might shift from a consistent application of the view of learning as developing insight when it comes to attainment of precision or refinement of a skill. He sets up two phases of skill development: the integrative aspect and the refinement or precision aspect.[64]. A few statements suggest that he regards the development of precision as different from the development of meanings. For example,

> When the need for skill appears in the experience, it should be developed through meaningful integrative orientation before attempting to give it the refinement and precision of a skill.[65].
>
> Learning occurs easily without repetition when the pupil is free to make his own meaningful conclusions between parts of less stable structure. Repetition should follow meaning to facilitate new organizations, not to block them.[66].

64. Ibid, p. 298 ff.
65. Ibid, p. 300.
66. Ibid, p. 305.

Burton[67] accepts this position of Hopkins as clearly providing for refinement of skills. The interpretation which Burton places upon Hopkins' discussion provides him with the basic pattern for his division of skill development into two phases. Burton's principles of learning for development of precision have been shown to be based upon a conception of learning which defines it as formation of a fixed sequence of habits.

However, Hopkins' principles of learning for development of precision appear to be somewhat different from Burton's. Hopkins does not discuss this problem as fully or as explicity as does Burton, but he gives two illustrations which indicate his possible position. In the first illustration he describes the activities of a third grade group studying a unit which involves handling money and development of arithmetic combinations. He summarizes the last phase of this group's activity as follows:

> ... Up to that time they had been taught no arithmetic for skill, although they had had many valuable

67. W. H. Burton, The Guidance of Learning Activities, p. 392, footnote, "The excellent discussion of skill in Chapter 8 of L. Thomas Hopkins, Interaction, is sometimes quoted as advocating the elimination of drill. The discussion is ideal but clearly provided for refinement of skills. Careful reading of the entire volume further supports this view."

> experiences in which number concepts were meaningfully developed ... After the accounts were settled and the profits determined, many of the children were interested in knowing more about the computations. To these children the teacher gave some exercises that they could test for themselves the fact that the same correct answers come when one adds up or down, or the same correct answers result in subtraction whether the borrowing or the equal additions method is used... The simple exercises were to aid some children to expand and clarify their meanings of addition, subtraction, and multiplication, not to help them build skill in computation.[68].

Hopkins does not describe what kind of exercises would be required to build skill in computation. However, he appears to eliminate use of mechanical repetition when he states, with regard to teaching penmanship, that, "All children should be allowed to develop their own organization of movements in refining their meanings to the necessary precision."[69]. He writes further,

> ... Many teachers believe that penmanship should be taught by a fixed system of graded exercises, each of which is a small unit step in a larger perfected structure. They have the children in the first grade practice "push and pull" and "around the house" until their adult standards are met. They fear that children will make many "errors" if allowed to develop their own patterns with the freer manuscript writing. Yet these very "errors" are developing insights in the flexible situation.

68. L. T. Hopkins, op. cit., p. 301.
69. Ibid, p. 304.

> If teachers accept skills as refined meanings they see the futility of fixed patterns of teaching them.[70]

Hopkins does not give, in either of these illustrations, any definite indication that he advocates use of conditioning principles for attainment of skill precision. In the latter illustration he suggests that such principles are futile in skill teaching since they represent fixed patterns of teaching. For this reason his position on this point appears to be different from that of Burton and to come closer than any we have yet examined to employment of a single definition of learning -- as development of insight.

For the purposes of the present study Hopkins' contribution consists mainly in the emphasis which he places upon the necessity of squaring principles of learning with a democratic philosophy. He rejects conditioning principles for use in school classrooms in a democratic society, and suggests application of principles which are derived from a relativistic pattern of thought. He maintains this position consistently in all types of learning situations, except possibly with respect to attainment of skill precision. The nature of Hopkins' text precludes the presentation of specific principles of learning. For this reason his exact position regarding principles applicable

70. Ibid, p. 305.

to attaining precision cannot be definitely determined.

D. Positions of Other Contemporary Writers.

Two other contemporary texts will be considered briefly. The authors present a view of learning similar to those which have already been discussed by the writer and because of this these texts are not analyzed in detail. A statement which indicates the position of the author is included.

First, in the text "The Nature and Conditions of Learning," the author, Howard L. Kingsley, summarizes a chapter on the nature of learning in these words,

> Learning is described in terms of functional modification. It cannot be described in terms of neurones and synapses. It is explained in terms of conditons correlated with progressive modification of functions. Explanations are sometimes made in terms of supposed conditions or events in the central systems. Such explanations are hypothetical. Of most concern to the one who seeks to promote learning in pupils are the known and manageable conditions of learning.[71]

In later chapters he develops what he considers the known conditions of learning and follows the pattern of conditioning psychology. He devotes an entire chapter to principles of conditioning and discusses their relation to learning as follows:

71. Howard L. Kingsley, The Nature and Conditions of Learning, p. 46.

> Some psychologists believe that the principles discovered in experiments on conditioning are operative in higher forms of learning and that they may be found adequate to explain the development of all forms of adaptive behavior. Others are inclined to the view that all learning cannot be accounted for in terms of conditioning principles alone. Some writers regard conditioning as a distinct form of learning. Others believe it represents only the "animal" form of human learning, which operates best when the conscious and attitudinal controls are undeveloped or suppressed. Some have noted similarities between conditioning as observed in experiments and the more complex forms of human learning, and while admitting that some conditioning principles may serve as explanatory concepts, hold that additional concepts are needed.[72]

Following this discussion of conflicting points of view, Kingsley states his belief that conditioning principles are adequate to explain all forms of learning. He writes,

> It seems clear that the learning which occurs in experiments on conditioning does have much in common with that which takes place in the schoolroom and in various situations of everyday life. But there are so many other factors entering into the higher forms of learning that the task of developing an all-embracing theory from conditioning principles becomes exceedingly involved. It means that these principles must be extended to explain not only the development of complex skills, memorizing, comprehension, and problem solving, but that they must account also for such factors in learning as attitudes, volition, motives, goals, conscious processes,

72. Ibid, p. 133.

> insight, and meanings. The fact that this appears difficult and involved does not mean that it cannot be accomplished. Noteworthy progress has already been made in this direction.[73].

He cites the work of Hull as representing an attempt to extend conditioning principles in the direction that is indicated. Hull's position has already been discussed and his writings will be analyzed in detail in a later section of the present study.

Second, in the text "Teaching in the Secondary School," the author, M. L. Goetting, refers briefly to a theory of learning in a section given to discussion of the learning situation. The book is primarily devoted to such problems as: objectives of secondary education; organization of instructional procedures; instructional planning; a unit plan of teaching; and, the guidance function of teachers. With regard to a theory of learning Goetting states,

> A discussion of the theories of learning does not come within the province of this volume. For the teacher and educational worker, these theories have two limitations, namely: (1) instead of giving explanations for learning, they merely attempt to describe it, and (2) each theory deals with some specific phase of the problem, and, consequently, does not interpret the complete process.

73. Ibid, p. 133.

> The vital relationship which teaching bears to learning, as has been pointed out above, justifies the teacher's attempt to gain a conception of the process as a whole. For a workable understanding of the complete learning process, the teacher must take an eclectic approach by combining the desirable features of several proposed theories.[74] It is only by evolving the characteristic features of learning in this way that the teacher can develop a point of view toward the work of teaching.[75]

An eclectic point of view has already been presented in this chapter, and the position of Goetting does not shed additional light on the problem at hand.

E. Summary.

The view of most of the writers discussed in this chapter corresponds in basic outline to that of McConnell in the 41st Yearbook. With the possible exception of Hopkins, each assumes that it may be necessary to use more than one principle to explain adequately all forms of learning. Principles which imply conditioning procedures are believed to be required to explain learning when meaningful organization is apparently not needed, as in development of skill precision. And, with the apparent exception of Kingsley, each assumes thatprinciples of

74. Italics not in the original.
75. M. L. Goetting, Teaching in the Secondary Schools, pp. 6-7.

learning based upon the development of insight are required to explain learning when development of meanings is desired. Kingsley suggests that insightful learning and development of meanings may eventually be explainable in terms of conditioning theory. He recognizes, however, that such a task is difficult and complicated.

The emphasis which these writers place upon the use of either conditioning principles or insight principles, respectively, varies. Risk apparently makes considerable use of conditioning principles in the classroom. He considers memorization as an important feature of learning in school situations, and regards these principles as applicable in this task. At the other extreme, Hopkins finds no place for conditioning principles in the classroom. He suggests that the usefulness of such may be limited entirely to an experimental laboratory.

Seven contemporary books have been considered in the foregoing two chapters. McConnell is the only author who has made a serious effort to reconcile the conflicts among contemporary theories of learning. However, any writer who deals with methods of teaching must, of necessity, imply basic principles of learning around which he organizes teaching situations. It is to be expected that none would advocate principles which they thought would work at cross-purposes to each other. In the sense that each

author regards his principles of learning as adequate to insure successful teaching, he has thereby dealt with the problem of formulating a theory of learning.

Three of the authors -- McConnell, Burton, and Risk -- specifically state that their proposals are tentative and that possibility of complete reconciliation of theories of learning must await additional data. They believe, however, that the division of learning principles which they suggest is required at the present time, and that it indicates an approach on which sound educational practice can be based.

# CHAPTER V

## ANALYSIS OF BASIC ISSUES UNDERLYING CONTEMPORARY PROPOSALS OF THORNDIKE AND HULL

It is the purpose of this study now to determine whether the division suggested by the foregoing writers is likely to prove successful in developing a theory of learning or whether a theory of learning can best be developed within the framework of either a realistic or relativistic view. The historical conflict between these two opposing points of view makes it necessary to analyze closely any proposal which suggests using principles from both. The conflict hinges almost entirely upon the assumption or non-assumption of the formation of specific neural connections as an explanation of learning. This is the basic issue on which realistic and relativistic views in psychology diverge.

At this point the present problem is essentially threefold, revolving around the following questions:

First, is an assumption of specific neural connections required by contemporary connectionism or conditioning theory? If this assumption is no longer required, the historical point of conflict disappears and a theory of learning based on the proposals of a writer such as McConnell may be acceptable. If, on the other hand, this

assumption is still required by connectionism, then such proposals represent a definitely dualistic position. Conflicts between the conception of learning as dependent upon a condition of the synapses, and the conception of learning as dependent upon the nature of a psychological field, will continually confront a teacher. Under such circumstances a teacher will have to adopt one set of procedures for certain learnings and another set for others, with no genuinely clear way of knowing when to use one and when the other.

Second, is it possible to employ the assumption of specific neural connections so as to explain adequately all forms of learning? (This question needs to be studied only if the answer to the first question is in the affirmative.) If it is possible to use principles of learning derived from such an assumption to provide a satisfactory explanation of behavior, as conditioning psychology presumes to do, then a theory of learning should be developed within the framework of this system. If this assumption is inadequate, then the solution to the problem must be sought elsewhere.

Third, is it possible to explain all forms of learning adequately without an assumption of specific neural connections? In other words, is it possible to explain learning phenomena adequately from the relativistic point of view?

If this appears possible, then this conclusion, if taken in conjunction with a negative answer to the second question, indicates that the theory of learning developed within the framework of this system should be accepted. If this appears impossible, then this conclusion, if taken in conjunction with an affirmative answer to the first question and a negative answer to the second, indicates that a dualistic position may be inescapable, for the time being at least, and the proposals of McConnell could be taken as representing this position. These three questions will be considered in the order stated.

In order to provide additional important background for this next section it is necessary to contrast at greater length the differences between the two points of view with respect to one issue uniquely related to the assumption that learning is dependent upon a condition of the synapses. This issue is the relation of repeated presentations of a stimulus pattern to the learning process. Under the realistic point of view, each occurrence of a stimulus-response sequence results in some modification within the synapse if learning occurs. This is considered sufficient to increase the probability that the next occurrence of the stimulus pattern will produce an identical response. Strict repetition in every minute detail is essential to this scheme, since there is no other way in which synaptic resistance can be reduced and

the habit established. If habit is considered a fixed sequence, established by lowered synaptic resistance through use, then each act in the sequence must follow each preceding act without variance. Otherwise, the law of use is not given opportunity to function.

Under the relativistic point of view, each stimulus-response sequence represents a new organization of the situation with respect to the goals established by the organism. Repetition of fixed sequences of acts is not essential to this scheme, since it is assumed that behavior is determined by the organization of the psychological field which exists at a given time. That is, behavior is determined by the goal which an individual has established and by the way he organizes the features of his environment to enable him to reach his goal. Repeated presentation of a situation may be part of a learning process in this view, but it is used as a means of providing repeated opportunities to enlarge the field (bring more data to bear on the situation) or to reorganize the data in order to provide insight into more effective working relationships.

The important difference which grows out of these opposing concepts of the function of repetition revolves around the question of providing opportunity for identical or varied repetitions. If each repetition directly modifies the nervous system by means of building fixed connections

between stimulus and response, then ideally each successive repetition should be identical until the exact connection is established. Proponents of the opposing view, on the other hand, seek to make each repetition different from all others, so as to provide on each occasion an opportunity for the development of new insight into relationships.

Some proponents of conditioning theory do not agree with the statement that, in order to increase the effectiveness of the stamping-in process, successive repetitions of the situation should be identical. The position taken by Guthrie, one of the writers for the 41st Yearbook, illustrates this point. Guthrie states that repetitions in a wide variety of situations are necessary to insure adequate learning. This should mean that the effect of repetition is to develop new insights; else, no variation should be permitted. He does not appear to imply, however, that these repetitions are for the purpose of developing new insights. He takes the position instead that successive presentations of stimuli will interrupt most of the repertoire of activities in which an organism may be engaged when learning. He implies that practice is necessary in order to extend the network of neural connections. He presents this idea as follows:

> In the Pavlovian experiment the so-called unconditioned stimulus, the stimulus used to insure the appearance of the response, was usually food, presented when the dog was hungry. He chose this 'unconditioned' stimulus for its effectiveness in eliciting eating and salivary secretion against distraction. Food to a hungry dog will prove effective in interrupting nearly any activity the dog is engaged in....
>
> But on the occasion of the first association the food is actually effective in only one such situation. It interrupts only one action or posture of the dog. If the next presentation of the signal finds the dog engaged in the same activity as before, the new cue will be effective after only one trial.
>
> But the chances of catching the dog in the same action or posture are remote. The second presentation of the cue may find the dog engaged in something very different. The cue has never been associated with the interruption of this activity. The new activity has never been associated with salivary secretion. The effect of the new activity is opposed to whatever associate effect the conditioner has acquired in its one association.
>
> . . . . . .
>
> . . . It appears that practice is necessary to the extent that the response must be elicitable from a variety of situations.[1]

Guthrie's position on this point does not represent a basic divergence from the assumption that occurrence of a stimulus-response sequence will result in some modification of neural connections. The above might possibly be taken to mean that learning is a function of development of insights. If so, it should be more clearly, less

1. E. R. Guthrie, "Conditioning: A Theory of Learning in Terms of Stimulus, Response, and Association," 41st Yearbook N.S.S.E., pp. 31-32.

equivocably, stated. It probably is intended to mean, however, that such modification as results from one occurrence of a stimulus-response sequence is sufficient to produce an identical response if other conditons are identical. Any approach to the problem of learning which requires an assumption that behavior is dependent upon a condition of the synapses is in opposition to the insight conception regardless of whether identical repetitions or varied repetitions are desired.

For the most part traditional conditioning psychology or connectionism regards repetition of identical stimulus patterns as desirable in ordinary learning situations. But they generally regard the unavoidable deviations from the desired condition as factors which will decrease the probability of learning. A relativistic conception of learning, on the other hand, anticipates changes in every situation, and assumes that one can increase the efficiency of learning in new situations if an opportunity has been provided to organize the elements of varied situations into recognized working relationships. This difference between the two points of view on the matter of the function of repetition is crucial to the following analysis of three systems of psychology.

A. Contemporary Connectionism.

According to certain contemporary writers, modern conditioning theory no longer requires the assumption of specific neural connections. For example, in a recent book (1940) Hilgard and Marquis state that,

> In the present status of knowledge, neural theory is not basic to conditioning theory. The known facts of neural function cannot be utilized to predict or to limit the results of behavioral studies....Many of the so-called neural facts, such as reflex inhibition, which seem most relevant to conditioning are in reality behavioral laws stated as relations between afferent and efferent nerve activity without direct observation of any intermediate neural activity.[2].

A similar statement of belief that the Thorndikian system of connectionism does not require this assumption is expressed in the 41st Yearbook, wherein Gates quotes Thorndike's definition to support the thesis that "The term connection, bond or tendency, does not refer to any neurological concept or agent at all."[3]. It is stated in other sources that the law of effect or the concept of belongingness which Thorndike has introduced is evidence of similarity between his views and those of relativistic psychologists. For example, Mowrer and Lamoreaux write,

2. E. R. Hilgard and D. C. Marquis, Conditioning and Learning, p. 336.
3. A. I. Gates, "Connectionism: Present Concepts and Interpretations," 41st Yearbook, N.S.S.E., p. 145.

> Some writers have equated associationism, in the sense of Pavlovian stimulus substitution, with the stimulus response "connectionism" of Thorndike. Instead of lumping both Pavlov and Thorndike together as associationists and contrasting them with the Gestalt, or "field theoretical" writers, the line should be drawn with Pavlov on the one side and with Thorndike and the field theorists on the other. Insofar as Gestalt psychology has a theory of learning and a concept of reinforcement, the resemblance to the Law of Effect is certainly greater than to the Pavlovian principle.[4]

The question of whether contemporary connectionism requires the assumption of specific neural connections is the first of the three basic questions to be considered next. Both Gates and Sandiford presented their interpretation of Thorndike for the 41st Yearbook and arrived as different conclusions on this issue. It is necessary to clarify this point for the present study and two of Thorndike's recent books, "Human Learning" and "The Fundamentals of Learning," have been selected for this purpose. The former consists of a series of lectures given at Cornell University in which Thorndike presented a revision of his earlier theories. The latter contains a more complete description of the experimental data on which the lectures are based. These two books supplement each other

4. O. H. Mowrer, and R. R. Lamoreaux, "Avoidance Conditioning and Signal Duration -- A Study of Secondary Motivation and Reward," Psychological Monographs, p. 1, footnote.

and have been considered by the writer as representing the contemporary view of connectionism. For the purpose of finding an answer to the present question, both connectionism and conditioning psychology are regarded as alike, since historically both points of view employ the same hypothesis.

In both of these books Thorndike discusses in detail the shift which has occurred in the thinking of psychologists particularly with regard to the potency of repeated presentations of stimuli in a learning situation. He makes reference to the criticisms which were directed at the "drill" feature of his earlier principles of learning and attempts to square his theories with these criticisms on the basis of data from a series of new laboratory experiments. He writes,

> The searching and critical analysis to which the concepts of learning, habit, and the association of ideas have recently been subjected, and the positive doctrines which have been advocated, are reviewed in the light of our experimental results .... we have tried to include the important facts and criticisms and to work out and present a reasonable solution as far as is possible from existing knowledge. This solution takes the form of a new associationism, or better, since it differs deeply and widely from the older British associationism, of a new connectionism.[5]

5. E. L. Thorndike, The Fundamentals of Learning, p. 4.

The experimental data which are pertinent to the present study are grouped under three divisions: (a) the repetition of a situation, (b) the repetition of a connection without belongingness, and (c) the repetition of a connection with belongingness. Thorndike differentiaties between repetition of a situation and repetition of a connection, as indicated in the statement,

> It should be noted that we are not in this chapter studying the influence of the frequency of occurrences of a connection, except insofar as it is a consequence of the frequency of occurrence of a situation. We are here controlling only the situation and letting it evoke such connections, and consequently responses, as it will. In later chapters we shall report experiments upon the influence of the repetition of a connection, in which a situation and some given response to it are presented repeatedly in temporal sequence, with or without a certain relevance or unity or mutual belonging.[6]

Thorndike will control first the "situation only" of a situation-connection-response sequence. In the lectures he posed the following question to illustrate the nature of the experiments designed to test the repetition of a situation. He asks, "What would happen if a man could be subjected to the same situation say 1,000 times, with everything else in the world and in him kept constant

6. Ibid, pp. 8-9 footnote.

save the thousand repetitions of the situations and the changes, if any, which they produce in him?"[7].

One of the experiments which he organized to provide a possible answer to this question involves repeated estimations of the lengths of strips of paper. He used different lengths, varying progressively by one-fourth inch, from five to eleven inches inclusive. There were ten strips of paper for each of these twenty-five lengths. The strips were shuffled together and each subject went through the entire series. By the end of the experiment each subject had gone through the entire series ten different times. Thus each given length was estimated one hundred times. The subjects were given no direct information which would enable them to determine the accuracy of their judgments. The results show,

> ... (1) that the tendencies to respond to a length to be judged constitute a susceptible, variable condition, (2) that with continued repetition of the situation this condition becomes less variable, tending toward stereotypism, but (3) that the more frequent tendencies do not gain at the expense of the less frequent.[8].

7. E. L. Thorndike, Human Learning, p. 8.
8. E. L. Thorndike, The Fundamentals of Learning, p. 11.

A second experiment of this type involved repeated attempts to draw, with the eyes closed, lines of different given lengths. The subjects were asked to draw lines of two inches, four inches, six inches, and eight inches in length and the experiment continued until each subject had repeated this sequence 950 times. They were never told how accurately they were estimating the required lengths. The results were similar to those of the first experiment. Thorndike summarizes as follows:

> The details of the other experiments we need not discuss. Their general result is in agreement with the samples so far described. So far as I can now see, the repetition of a situation in and of itself has no selective power. If a certain state of affairs acts upon a man 10,000 times, he will, as far as any intrinsic action of the 10,000 repetitions is concerned, respond in the same way to the last thousand as to the first. The repetition of a situation may change a man as little as the repetition of a message over a wire changes the wire. In and of itself, it may teach him as little as the message teaches the switchboard. In particular, the more frequent connections are not selected by their greater frequency.
>
> ... Experience, in the sense of merely confronting and responding to the situations of life, can hardly be a powerful agent for either good or harm when several thousand repetitions of such an experience do so little.[9]

This conclusion implies that no direct connection between stimulus and response can be built by repeated

9. E. L. Thorndike, Human Learning, pp. 14-15.

presentation of a stimulus pattern. To this extent, the conclusion is different from what one would expect if Thorndike followed his earlier position. It differs also from the implications of Pavlov's explanation of basic conditioning phenomena.

Thorndike's experiments are different in organization from those which ~~those which~~ attempt to establish simple conditioned responses, but with respect to certain aspects of the control of the situation they are similar. Thorndike attempts to control the situation only of a situation-connection-response sequence. Simple conditioning procedure, of the type described by Pavlov in his early experiments in conditioning the salivary reaction of a dog, is primarily concerned with simultaneous presentation of two stimuli (unconditioned and conditioned). This represents, approximately, control of the situation only, in the sense in which Thorndike describes it, and his conclusion above seems to rule out the possibility of explaining the conditioning phenomena. Thorndike recognizes this conflict between his conclusion and conditioning theory and states,

> .... I am at present inclined to believe that there is a real conflict between the C-R phenomena and ordinary learning in the sense that neither will explain the other, and in the further sense that modifiability by a shift of certain X's from connection with A to connection with

> the precursor and overlapper of A occurs, and operates in ways radically different from those in which ordinary learning operates.[10]

He goes on to suggest an experiment in which these differences could be tested.

> .... some investigator would observe animals of the same species forming the same connections, some by the C-R procedure and some by belonging, repetition, and reward. We hoped to do this, using adult man, but have been so far thwarted by extreme difficulty in obtaining connections through the C-R procedure. ....[11]

The second set of experiments from which Thorndike develops his later principles of learning are intended to control both the situation and connection within a situation-connection-response sequence, and to test the influence of repeated occurrences of a connection without belongingness. For the purpose of these experiments Thorndike defines the term connection as,

> .... That a connection $S_1$ ---- $R_1$ exists in a certain organism means in this study simply that there is a probability greater than an infinitesimal that, if $S_1$ occurs, $R_1$ will occur. In practice, very low probabilities, say of less than .0001, will not be called connections.[12]

10. E. L. Thorndike, The Fundamentals of Learning, p. 411.
11. Ibid, pp. 411-412.
12. Ibid, pp. 18-19.

A similar definition is given in the lectures,

> The term connection has been used without prejudice concerning what physiological event or condition parallels it or constitutes it. It is, so far, simply an expression of the probability that a certain S will be followed by a certain R. Bond, or link, or relation, or tendency, or any still more colorless word, may be put in its place.[13]

One of the experiments in this section involved the use of ten sentences, such as the following, to provide material for testing learning.

> Alfred Dukes and his sister worked sadly.
> Edward Davis and his brother argued rarely.
> Francis Bragg and his cousin played hard.
> Barney Croft and his father watched earnestly.

These sentences were read in consecutive order ten times. The subjects were immediately tested on their ability to recall the words which followed words such as "Alfred" on the one hand, and "sadly" on the other. They were able to recall the word that followed words such as "Alfred" much more easily than those which followed words in the same position as "sadly." The belongingness of a first name with a last name apparently made this sequence much easier to remember. On the other hand, the adverbs belonged with the sentence unit which preceded them, and the subjects were unable to recall the connection which each

13. E. L. Thorndike, Human Learning, p. 7.

adverb had with the beginning word of the next sentence. There were, of course, as many repetitions of an adverb-name sequence as there were of a first name-last name sequence. The adverb name sequence, however, was not recalled oftener than could be expected by chance.

Another experiment, similar to the preceding one, consisted of ten groups of four sentences each in which a set of first names varied with a given last name; a set of last names varied with a given first name; and, a set of adverbs varied with a given verb. One group of four sentences goes as follows:

> Alfred Duke and Ronald Barnard worked sadly.
> Edward Duke and Ronald Foster worked lightly.
> Francis Duke and Ronald Hanson worked here.
> Barney Duke and Ronald Curtis worked to-day.

This sequence of forty sentences was repeated to the subjects six times and they were immediately asked to give the word which followed, for example, "sadly," "Alfred," or "Duke and." As in the previous experiment, the subjects would give the first name-last name sequence easier than they could give the word which followed "sadly" or "Duke and." The sequence "Duke and Ronald" was repeated in that order four times as often as the words "Alfred Duke," but this fact did not enable the subjects to remember which word came after "Duke and" oftener than could be expected by chance. The greater belongingness of a first

name with a last name was a much more important factor in learning this material than the repeated occurrence of a given sequence. Thorndike summarizes the comparison as follows:

> ... With only a fourth as many repetitions the greater belongingness results in much greater strengthening, producing nearly twice as many correct responses. ...[14].

A slightly different type of experiment in this same series consisted of well known words paired with two-digit numbers as, "bread 19, wall 16, Texas 78." The entire list contained 1305 pairs; the number of repetitions for the various pairs varied. Four special pairs each occurred 21 times and were placed so that the word always followed the same number. Thus the sequence "42 dregs 91" and "86 charade 17" appeared 21 times. The subjects were given two types of tests, (a) a test of their ability to recall the numbers which followed selected words, (b) a test of their ability to give the word which followed the numbers "42" and "86," for example. The subjects were unable to perform on the second test above chance expectations. They were able to recall many of the numbers which followed given words. Thorndike explains this result,

14. E. L. Thorndike, The Fundamentals of Learning, p. 68.

> The nature of the instructions, the way in which the pairs were read and the habits of life in general, led the subjects to consider each word as belonging to the number that followed it, and each number as belonging to the word that preceded it. In this experiment, the temporal contiguity of a number with the word following it, the mere sequence without belonging, does nothing to the connection.[15]

Thus, because of the lack of belongingness between a number and the word which followed it, such connections were not formed even though a few sequences of a given word following a given number were repeated oftener than some of the reverse sequences which were learned.

In still another, more complicated experiment, Thorndike used a series of nonsense words printed on cards. He presented these cards to the subject with the simultaneous speaking of an English word, always pairing the same English word with the same nonsense word. The cards varied in size and the spoken English word varied as to part of speech according to the size of the card. Verbs were spoken when a sixteen-inch card was presented, adjectives when a twelve-inch card was presented, etc. The cards were held at different distances from the top of the table and the number of syllables of the spoken English word varied with the height at which the card was held. One-syllable words were

15. Ibid, pp. 70-71.

spoken when the cards were held three feet from the table; three-syllable words when the cards were held at two feet; and, two-syllable words when the cards were held at a distance of one foot. The subjects rarely noticed the distance relationships or the part of speech relationships. They learned to pair the given English word with the nonsense word without recognizing and using these factors. Thorndike explains these results as follows:

> The results of such experiments cannot be dismissed as matters of insufficient attention to the various aspects of the two terms of the sequence. The subjects are aware of the size of the card, the position at which it is held, the grammatical class of the English word spoken, and the number of syllables in it. These features of the two terms of the sequence do produce effects in the neurones. .... But they are not aware of the grammatical class of the English word or the number of syllables in it as belonging to or due to the size and position of the card. They do not attend to these connections as they do to the connection between nonsense word and English word. Attentiveness to various features of the two terms as mutually belonging will strengthen the connection more than inattentiveness, of course. But attentiveness to these features, no matter how vigorous, will do little or nothing to strengthen a connection between them, unless it includes attentiveness to them as belonging.[16]

The emphasis in this last group of experiments is upon determining the effect of repetition-without-belongingness upon learning. In no case did repetition of a connection

16. Ibid, p. 75.

without belongingness give evidence of assisting in learning the connection. Results of the tests on this feature were no better than could be expected by chance. The last experiment indicates, further, that existence of belongingness is not beneficial to learning unless the subject is aware of it. To the writer it seems entirely clear that the learning which occurred in these experiments is dependent entirely upon a subject's recognition of belongingness between a stimulus and a response. In other words, Thorndike possibly to the contrary, these results seem to be thoroughly in keeping with the principle of learning as a process of developing insight.

Thorndike proposes to test more specifically the effect of repetition of a connection with belongingness. The experiments in this next section are of the same general type already described. In one of these, words paired with two-digit numbers make up the learning material. He classifies pairs such as "bread 19, wall 16," as "neutral pairs" and compares the ease with which these pairs were learned with those which had "pleasant first members" as "love 40, kiss 60," and those which had "unpleasant first members" as "vomit 21, hate 73." He found that pairs which had either unpleasant or pleasant first members were recalled more frequently than neutral pairs. In another experiment of

exactly the same nature he interspersed pairs such as "twins 22, youth 16, thirty 30, unlucky 13, cube 27, foot 12, half 50, last 99" among neutral pairs. This type of pair was recalled more frequently (than most of the neutral pairs,) even with fewer repetitions. The quality of belongingness which is evident in these pairs apparently made them easier to recall. Still another experiment involved learning various number series. Thorndike paired three-digit numbers with two-digit numbers, inserting meaningful pairs such as "123 45, 135 39, 369 33, 111 33, 100 99, 456 56;" among other pairs composed of numbers assembled at random. Here again repetition with this type of belongingness was superior to repetition of the pairs assembled without regard for special relationships.

Data from these three sets of experiments, organized to test (a) the repetition of a situation (control of the stimulus only in a stimulus-connection-response sequence), (b) the repetition of a connection without belongingness (control of the stimulus and connection), and (c) the repetition of a connection with belongingness, lead Thorndike to the conclusion that belongingness is a quality which is necessary to establish a connection. There is nothing in the data indicated thus far which would suggest an assumption of neurological bonds. The data show that

mere repetition of a specific stimulus-response sequence does not necessarily increase the probability that the specific response will follow the stimulus upon presentation of the stimulus only. On the other hand, repetition of a stimulus-response sequence which "belongs together" does increase the probability that the specific response will be evoked by presentation of the specific stimulus.

It is necessary now to consider Thorndike's explanation of these data. If his explanation is based upon an interpretation of belongingness as a sensing of relationships by the subject, then his position is similar in this respect to a relativistic theory of learning. If his interpretation of belongingness, on the other hand, includes the assumption that learning is determined by synaptic changes, then belongingness has the same relation to learning as his earlier concept of a satisfying state of affairs. Thorndike describes what he implies by the use of the word belonging in the following statement.

> The belonging which is always or nearly always necessary in order that the repeated occurrence of a sequence may strengthen the connection between the first term of the sequence and the second need not be more than the least which the word implies. There need be nothing logical, or essential, or inherent, or unifying in it. Any "this

> goes with that" will suffice. Each nonsense syllable in a series which is read as a series "belongs" to the one before it in the series. ... [17].

This description does not rule out meaningful organization as a requirement of belongingness, but Thorndike apparently believes that it does. Any "this goes with that" does not necessarily insure that the learner will be able to establish relationships between the required stimulus-response sequence. A learner has somehow to recognize the this-goes-with-that connection. However, Thorndike implies that the belongingness of which he speaks can be secured without such recognition by the learner. Yet his own data refute such a position. If belongingness can be arbitrarily introduced in this way, then there is no need for the subject to engage actively in the business of organizing these sequences into meaningful relationships. Thorndike implies that if belongingness exists between a stimulus-response sequence, a subject will learn such a connection if it is repeated often enough.

Instructions which Thorndike gave to certain subjects indicates that he believes the quality of belongingness is sufficient to insure learning only if a connection is repeated often enough. None of the instructions include any

17. Ibid, p. 72.

statement that would suggest to the subjects that they should seek to establish relationships among the items of material to be learned. He apparently assumes on all occasions that the process of learning connections which have belongingness still requires repetition to make it effective. Some of his experiments are organized in such a way as to indicate that, in a repetition-with-belongingness situation, whatever learning takes place is primarily dependent upon repetition. In these experiments the subjects are given instructions intended to keep them from engaging in any active effort to organize the material. For example, he writes,

> We have sought to obtain closer approximations to the activity of repetition plus belonging without the influence of the consequences of the connection, by using a different form of presentation of the connected pairs, by instructing the subjects in certain ways, and by concealing or disguising the learning which we test later.
>
> The most usual plan of our experiments to this end is to present long series of pairs (from about 500 to 4000) in which certain pairs recur often, with instructions to the subjects to listen comfortably without any effort to remember and without thinking what is heard, just experiencing what is provided. ...[18]

If a subject is not supposed to make any active effort to organize the pairs into meaningful relationships, as

18. Ibid, p. 78.

indicated by these instructions, then the assumption that learning occurs as a result of repeated transmissions of sense impressions is logically implied. The description shows that, for these experiments, Thorndike seeks to obtain completely passive subjects who "just experience" what is provided. If connections can be established by passive individuals, repetition of a stimulus pattern is the only way in which it can be accomplished. For Thorndike then, repetitions are not for the purpose of developing new and different relationships but rather for the purpose of building up increments of connection strength. This requires the assumption that behavior is dependent upon synaptic changes if it is to have meaning at all. Such a conception is evident in this statement,

> From our data as a whole, it appears probable that the influence of actual occurrences shows little evidence of diminishing returns up to the point where a strength of 100 to 200 per mille is reached. And they do not absolutely disprove the hypothesis that one occurrence adds the same amount of strength whenever it occurs, the apparent diminution being possibly due to the effects of mixture noted above, and to other factors, such as the acceptance of certain pairs as learned and the devotion of attention to other pairs by subjects who disregarded the instructions...[19]

19. Ibid, p. 130.

Thorndike still holds to the hypothesis that repetitions, at least of equal intensity, will provide equal increments of strength in establishing a connection. And what changes "intensity" is not discussed. He assumes that repetition with belongingness establishes a connection by a gradual building-up process.

The principles of learning under this scheme are basically no different from those which traditional conditioning psychology and connectionism have assumed. The fact that Thorndike has differentiated between repetition-without-belongingness and repetition-with-belongingness has no real significance for a theory of learning if learning is still regarded as development of fixed sequences of habits. If Thorndike interprets belongingness as implying a sensing of relationships, then the hypothesis that equal increments of connection strength occur with each presentation of a stimulus pattern is unnecessary. Development of a sense of relationships is not likely to occur by regular stages.

Thorndike's adherence to his stated assumption regarding the regularly cumulative effect of occurrence of a stimulus pattern implies the additional assumption of fixed neural connections. That he makes such an hypothesis is shown in his discussion of the neurological basis for the concept of belongingness. He states,

> ... As to the physiological basis of belonging, there are at the present no hypotheses to disagree about. The one which I offer is the wery simple one that belonging is the consequence of direct continuity in conduction.[20] When neurones a, b, c, etc., or neurone patterns 1 and 2 conduct into neurones $\alpha$, $\beta$, $\gamma$, etc., or neurone patterns I and II there is belonging. Otherwise there is not. The more fully all of a, b, c, etc., or 1, 2, etc., conduct into $\alpha$, $\beta$, $\gamma$, etc., or I, II, etc., and into no other neurones or neurone patterns, the greater is the belonging.[21]

If belongingness is the result of "direct continuity in conduction," Thorndike's theory of learning is not different from what it was in 1912. The explanation of why neurone "a" conducts into neurone "$\alpha$" cannot be based upon a concept of sensing relationships, for Thorndike assumes that continuity in conduction is a pre-requisite of belongingness. Some unexplained condition of the synapses is required to explain the phenomena under these assumptions.

It is evident from the foregoing that Thorndike does not undertake the experiments reported in the two volumes under consideration with a set of hypotheses different from those with which he worked earlier. Nor does he interpret the data from his recent experiments in such a way as to require a change in his basic assumptions. The concept of belongingness which he introduces is interpreted by him

20. Italics not in the original.
21. Ibid, p. 76.

on a strictly neurological basis, and is itself dependent upon a pre-existing condition of the synapses. It thus has no relation to the relativistic view which is that learning is dependent upon a sensing of relationships between stimuli and responses.

The above analysis of Thorndike's interpretation of belongingness is strengthened when one considers other features of his later system of psychology. He mentions the relationship between belongingness and the Law of Effect in these words:

> Additional evidence that the repetition of a belonging sequence strengthens the connection even though there is no satisfying after-effect will appear when we study the comparative strength of satisfying and annoying consequences in weakening connections. We shall find that under certain conditions making a wrong response and being told that it is wrong does not weaken but actually strengthens the connection. The connection gains more strength by occurring than it loses by the annoucement that it is wrong.[22].

In the above quotation the strength of a sequence-with-belongingness is assumed to be greater than satisfying after-effects. This is different from his conclusions as given in the Cornell lectures. In the latter he reports that,

22. Ibid, p. 113.

> Repetition of a connection in the sense of the mere sequence of the two things in time has then very, very little power, perhaps none, as a cause of learning. Belonging is necessary. Even when supplemented by belongingness and acceptability it is weak, and seems to need something more to help it account for learning.[23].

In this context Thorndike does not state his explanation as to what causes the "belonging." If he applies his hypothesis that belonging is the consequence of direct continuity in conduction, then he does not consider it necessary that a learner recognize a belongingness of one sort or another. Thorndike points out in the paragraphs which follow the last quotation that after-effects of a connection are a stronger factor in strengthening or weakening it than belongingness. He then proceeds to discuss the neurological basis for an explanation of the effect which satisfying and annoying consequences have upon the strengthening of connections. He summarizes[24] this position with an exact restatement of material from his text "The Original Nature of Man," published originally in 1912. (The quotation has already been included in the present study.) In it he discusses the various possibilities of synaptic changes and states definitely that learning is a function of the synapses.

23. E. L. Thorndike, Human Learning, pp. 28-29.
24. Ibid, pp. 58-59.

Not only is the Law of Effect explained on the basis of neural connections, but Thorndike includes evidence in this later text which indicates that he explains purposive behavior on the same basis. In a chapter in which he compares his statements directly with criticisms of his theory he makes the following statement.

> Many of the criticisms of connectionist psychology ... consist in dignified elaborations of the thesis that they can write many names and the like, and that consequently connectionist psychology is unsound. Obviously I can write Thornjjj, Thornxzfp, or Thornquvp. But that does not prove that purposes are not made out of connections and readinesses or that action of the brain is organized by Gestalten over and above the connections born and bred in the neurones, or that learning is not connecting.[25]

Taken as a whole, connectionistic psychology as represented by Thorndike cannot be separated from the assumption of fixed neural connections. Gates' interpretation of Thorndike, as presented in the 41st Yearbook, overlooks the data which indicate that Thorndike has never given up his assumption that learning consists in the formation of fixed sequences of habits. The apparent similarities between Thorndike's belongingness and a relativistic conception of sensing relationships are not real, as is evident

25. Ibid, p. 428, footnote.

from his statement on the neurological hypothesis of belongingness.

This weakens the position of McConnell who bases his proposals for reconciliation of learning theories upon apparent similarities between connectionism and relativism. A conflict between the later position of Thorndike and relativism in psychology is still present, and it is based upon the same divergence of views as that which produced earlier conflicts. In view of this, the problem of developing a theory of learning depends now upon an answer to the two remaining questions, namely, can (a) conditioning theory or (b) field theory adequately explain all phases of learning if consistently applied?

## B. An Explanation of Learning Based Upon an Extension of the Laws of Conditioning.

The second phase of the problem centers around examination of data which bear upon the question of whether conditioning principles can be extended so as to explain adequately all phases of learning. The system of conditioning proposed by Clark L. Hull in his book, "Principles of Behavior," has been selected as the main source of data in an attempt to develop such principles. This text is considered by some as a satisfactory approach to the problem of reconciliation. In a special book review

published in the Psychological Bulletin, Sigmund Koch writes,

> The prospects for unified theory in psychology seem a little brighter when it is realized that most "rival" psychological theories may, in spite of their terminological individuality, be regarded as largely intertranslatable variants of only two theoretical approaches: "S-R" theory and "field" theory. The feeling has long been prevalent that these two classes of theory are basically opposed on many crucial issues. Principles of Behavior marks a major step toward the reduction of this apparent opposition. Certain changes in Hull's system -- notably the recognition of the hypothesis of "neural interaction" -- make it possible to deduce from S-R assumptions many of the phenomena formerly assumed by the field theorists to be compatible only with their own tenets. Advocates of unified theory in psychology have reason to be highly encouraged by this development.[26]

Hull published an article on "The Conflicting Theories of Learning -- A Way Out" in which he submits the first principles for the development of his present theory and shows that he considers his work as representing a method of reconciliation of basic differences.[27] Hilgard and Marquis regard the text as an attempt to "bridge the gap from conditioned responses to more complex forms of learning."[28]

26. Sigmund Koch, "Hull's Principles of Behavior," Psychological Bulletin, Vol. 41, May 1944, pp. 269-286.
27. Clark L. Hull, "The Conflicting Psychologies of Learning -- A Way Out," Psychological Review, Vol. 42, Nov. 1935, pp. 491-516.
28. E. R. Hilgard & D. G. Marquis, Conditioning and Learning, p. 16.

These authors also submit a personal communication from Hull which indicates his belief that no significant differences exist between his and field theory. Hull's communication goes as follows:

> As I see it, the moment one expresses in any very general manner the various potentialities of behavior as dependent upon the simultaneous status of one or more variables, he has the substance of what is currently called field theory. My habit-family hypothesis is presumably a field principle in this sense. It is possible that my equation expressing the goal gradient hypothesis (gradient of reinforcement) and even the one expressing the generalization gradient (gradient of irradiation of Pavlov) might also qualify as bits of field theory.... if one means by field theory what I have indicated, I am all for it and see no inherent disagreement on this point between stimulus-response theory and Gestalt theory.[29].

The description of field theory in the foregoing quotation is an inadequate appraisal of the effects in psychology which follow from an application of relativistic philosophy. Recognition that one or more variables may affect behavior at any given time is not a unique contribution of field theory. Behaviorists, such as Watson, include this concept in their theory, but seek to explain behavior on the basis of the reflex arc concept. Hull

29. Ibid, p. 254.

overlooks the real issue between field theory and behaviorism. Field theory emphasizes the relation of environmental variables to behavior but this does not represent the factors which differentiate it from other points of view.

Hull has developed an elaborate system of mathematical formulae as a basis for a theory of rote learning.[30]. In order to interpret these formulae it is necessary to refer to a set of basic postulates and assumptions which underlie the mathematical derivations. His 1940 text gives these postulates and is relatively free of the mathematical part of his theory. Nor does Hull's contribution to the 41st Yearbook, wherein he deals with a theory of learning exclusively, include much reference to mathematics. For this reason, it is considered justifiable to omit the mathematical material from the present study and refer directly to the basic postulates which he outlines in his latest text.

Hull establishes his problem as basically that of elaborating molar laws of behavior rather than molecular laws. He states that the "objective of the present work is the elaboration of the basic molar behavioral laws underlying the 'social' sciences."[31]. He describes the problem more fully thus,

30. Clark L. Hull, et al., Mathematico-Deductive Theory of Rote Learning, 1940, 339 pp.
31. Clark L. Hull, Principles of Behavior, p. 17.

> It is the primary task of a molar science of behavior to isolate the basic laws or rules according to which various combinations of stimulation, arising from the state of need on the one hand and the state of the environment on the other, bring about the kind of behavior characteristic of different organisms...[32].

These two expressions, state of need and state of environment, are presumably the variables to which Hull refers when he states the basic requirements of field theory.

In discussing the organic basis of adaptive behavior he writes,

> From the foregoing considerations it might appear that the science of behavior must at bottom be a study of physiology... Nearly all serious students of behavior like to believe that some day the major neurological laws will be known in a form adequate to constitute the foundation principles of a science of behavior.[33].

He makes it clear from the beginning that his approach to the problem is based upon the neurological concepts of Pavlov and his followers. He states,

> Certain molar behavioral observations render it extremely probable that the after-effects of receptor stimulation continue to reverberate in the nervous system for a period measurable

32. Ibid, p. 19.
33. Ibid, p. 19.

> in seconds, and even minutes, after the termination of the action of the stimulus upon the receptor.... Such bits of evidence as these tend to substantiate the stimulus-trace hypothesis of Pavlov which is used extensively in the present work.[34]

Hull assumes the same type of reflex-arc mechanisms common to behavioristic psychology. For example,

> Certain adaptive situations are of such regularity that ready-made chains of reflex receptor-effector connections are adequate for survival, e. g., the blinking of the eyelid at any rough contact with the cornea. In many chains of reflex activity the action of the environment supplies indispensible links of the chain, as in the suckling of a young animal.[35]

He does not assume that his system offers a complete explanation of purposive behavior, as yet. He believes, however, that attempts to explain such phenomena should be based upon a reflex arc concept and proceed, in additive fashion, from simple connections to complex patterns. He writes,

> An ideally adequate theory even of so-called purposive behavior ought, therefore, to begin with colorless movement and mere receptor impulses as such, and from these build up step by step both adaptive behavior and maladaptive behavior. The present approach does not deny the molar reality of purposive acts (as

34. Ibid, pp. 41-42.
35. Ibid, p. 56.

> opposed to movement) of intelligence, of insight, of goals, of interests, of strivings, or of value; on the contrary, we insist upon the genuineness of these forms of behavior. We hope ultimately to show the logical right to the use of such concepts by deducing them as secondary principles from more elementary objective primary principles. ...[36].

Hull develops his principles of behavior from sixteen postulates which are scattered throughout the text. The first four, presented below, are representative. The main features of his treatment of the problem of learning are based upon these four.

Postulate I:

> When a stimulus energy (S) impinges on a suitable receptor organ, an afferent neural impulse (s) is generated and is propagated along connected fibrous branches of nerve cells in the general direction of the effector organs, via the brain. During the continued action of the stimulus energy (S), this afferent impulse (s), after a short latency, rises quickly to a maximum of intensity, following which it gradually falls to a relatively low value as a simple decay function of the maximum. After the termination of the action of the stimulus energy (S) on the receptor, the afferent impulse (s) continues its activity in the central nervous tissue for some seconds, gradually diminishing to zero as a simple decay function of its value at the time the stimulus energy (S) ceases to act.[37].

36. Ibid, p. 25.
37. Ibid, p. 47.

Postulate II:

> All afferent neural impulses (s) active in the nervous system at any given instant, interact with each other in such a way as to change each into something partially different (s̆) in a manner which varies with every concurrent associated afferent impulse or combination of such impulses. Other things being equal, the magnitude of the interaction effect of one afferent impulse upon a second is an increasing monotonic function of the magnitude of the first.[38]

Postulate III:

> Organisms at birth possess receptor-effector connections ($_sU_r$) which, under combined stimulation (S) and drive (D), have the potentiality of evoking a hierarchy of responses that either individually or in combination are more likely to terminate the need than would be a random selection from the reaction potentials resulting from other stimulus and drive combinations.[39]

Postulate IV:

> Whenever an effector activity ($r \longrightarrow R$) and a receptor activity ($S \longrightarrow s$) occur in close temporal contiguity ($_sG_r$), and this $_sG_r$ is closely associated with the diminution of a need (G) or with a stimulus which has been closely and consistently associated with the diminution of a need ($\dot{G}$), there will result an increment to a tendency ($\triangle {}_sH_r$) for that afferent

38. Ibid, p. 47.
39. Ibid, p. 66.

> impulse on later occasions to evoke that reaction. The increments from successive reinforcements summate in a manner which yields a combined habit strength ($_sH_r$) which is a simple positive growth function of the number of reinforcements (N). ..[40]

Hull places considerable emphasis upon the relation of habit strength to the number of reinforcements and devises a unit of measure which he calls "hab." One hab is defined as one per cent of the physiological maximum of habit strength obtainable by a standard organism under optimal conditions.[41]

The assumptions implied in these postulates are no different from those of Watson and Pavlov. Hull has included reference to drive and need, but the basic emphasis upon a strict correspondence between given receptors and effectors is the same as that of other realists in psychology. The derivation of a conception of learning within this framework of thought is shown in the following quotations. He describes the basic nature of the learning process in these words:

> ... That learning does in fact greatly improve the adaptive quality of the behavior of higher organisms is attested by the most casual observation. But the detailed nature of the learning process is not revealed by casual observation; this becomes evident only through the study

40. Ibid, p. 178.
41. Ibid, p. 114.

> of many carefully designed and executed experiments.
>
> The essential nature of the learning process may, however, be stated quite simply. Just as the inherited equipment of reaction tendencies consists of receptor-effector connections, so the process of learning consists in the strengthening of certain of these connections as contrasted with others, or in the setting up of quite new connections.[42]

The difference between innate and acquired connections is then presented. He proposes the law of primary reinforcement, more or less a restatement of Postulate IV, to explain the strengthening of innate connections.

> ... Whenever a reaction (R) takes place in temporal contiguity with an afferent receptor impulse (ṡ) resulting from the impact upon a receptor of a stimulus energy (S), and this conjunction is followed closely by the diminution in a need (and the associated diminution in the drive, D, and in the drive receptor discharge, (S), there will result an increment $\triangle$ (ṡ --- R) in the tendency for that stimulus on subsequent occasions to evoke that reaction....[43]

The above law of primary reinforcement becomes Hull's basic law of learning, for when he considers the problem of acquisition of new receptor-effector connections and the phenomena of the conditioned reflex he regards both as special cases of primary reinforcement.

42. Ibid, pp. 68-69.
43. Ibid, p. 71.

With regard to new connections he states,

> We now proceed to the consideration of the formation of a genuinely new receptor-effector connection. This turns out to be only a special case of the law of primary reinforcement which we have just formulated. ...[44].

He then proceeds to illustrate by diagram the simultaneous convergence of impulses which follow previous connections. At the time of convergence the increased impulse strength is assumed to be sufficient to establish a completely new connection. The exact connection which finally is established is considered as dependent upon the particular combination of impulses that converge.

With regard to the conditioned reflex, Hull states,

> A special case of the action of the principle of reinforcement sketched above is found in the type of experiment in which there is set up what is indifferently called the conditioned reflex or the conditioned reaction. ...[45].

These data indicate that up to this point Hull has followed closely a traditional realistic approach to problems of psychology. He makes no mention of synaptic changes which are required to assure learning except, perhaps,

44. Ibid, p. 73.
45. Ibid, p. 74.

in Postulate I where he states that an afferent neural impulse is propagated along "connected fibrous branches of nerve cells." Relativists in psychology maintain that a concept of direct one-to-one correspondence between stimulus and response can not explain behavior which involves adaptations to complex and infinitely varied situations.

Hull's answer to this objection is believed by some (Koch and McConnell, for example) to be found in his hypothesis of neural interaction. The statement of this hypothesis is:

> It would appear that a given afferent receptor discharge (s) is modified by interaction with other receptor discharges ($s_2$ or $s_3$) on their way to or actually entering the central nervous system at about the same time. ...[46].

He illustrates the application of this principle as follows:

> ... For example, a small patch of gray paper ($s_1$) resting on a large piece of blue paper ($s_2$) will be reported by a subject as yellowish, but when resting on a large piece of red paper ($s_3$) it will be reported as greenish. It seems probable that the neural impulses initiated by the light rays arising from the patch interact with the afferent

46. Ibid, p. 43.

> impulses arising from adjacent portions of the retina in such a way as to change somewhat the course of each....
>
> In case of afferent impulses entering the brain from distinct types of receptors such as those for light and sound, there is less opportunity for neural interaction than within a given receptor such as the retina...[47].

The hypothesis of neural interaction is applied also to what Hull calls stimulus generalization. For example,

> The reaction involved in the original conditioning becomes connected with a considerable zone of stimuli other than, but adjacent to, the stimulus conventionally involved in the original conditioning; this is called stimulus generalization.[48].

The thesis that Hull's concept of neural interaction or stimulus generalization does not imply a one-to-one correspondence between receptor and effector organs is questionable when one analyzes the important statements of his theory. The application of his principle with respect to the changing appearance of a gray piece of paper when the background is changed indicates that a close spatial relationship of nerve fibers is more conducive to neural interaction than if they are widely separated. Neural interaction, as proposed by Hull, is thus dependent upon some definite neural connection between stimulus and response. The fact that these connections may have been modified by neural interaction because

47. Ibid, pp. 43-44.
48. Ibid, p. 183.

they are part of a vast network of other nerve fibers does not change the necessity for beginning with single units such as are implied in the reflex-arc concept. These single units are required by Hull's system and in this respect he is still in direct opposition to field theory.

Furthermore, since Hull's theory of learning is based upon a law of primary reinforcement which he has described in terms reminiscent of Thorndike's principles of habit formation, it is evident that this phase of his theory also implies a reflex-arc concept. He discusses the question of habit formation in these words,

> The effect of reinforcement may become manifest in overt action upon the presentation of the associated stimulus at any time during the subsequent life of the organism. This central fact shows conclusively that reinforcement leaves within the organism a relatively permanent connection between the receptor and the effector associated in the original reinforcement. It is this which in the present system is meant by the term "habit," a technical adaptation of the common-sense concept that goes by the same name.
>
> Since the organization of the nervous system upon which habitual action is based lies deeply hidden and quite remote from any immediate means of direct observation, habit has the status of an unobservable, i. e., it is a logical construct. ...[49].

49. Ibid, pp. 117-118.

A concept of reinforcement whereby repetitions result in successive increments of habit strength (Law of Primary Reinforcement) implies an assumption of rather direct receptor-effector connections as the basic unit of habit formation. If these connections are not considered to have a relatively close one-to-one correspondence, the proposal that habit strength increases progressively as the number ofreinforcements is illogical. Reinforcement must apply to specific connections, not to the nervous system as a whole. Hull recognizes that the exact organization of the nervous system is unobservable, but his "logical construct" or hypothesis used to explain habit is that of the reflex arc.

He uses this consistently in all phases of his theory and points out a difference between Gestalt theory and his position, in the chapter wherein he discusses the patterning of stimulus compounds. He summarizes,

> After studying the above chapter the reader may naturally ask what the relation of the present behavioristic treatment of the configurational problem in learning is to that put forward by the Wertheimer branch of the Gestalt school....
>
> Gestalt Theorie asserts that configurations are not only logically primary but that they are somehow primordial. Indeed, if current configurationism is ever formulated as a true scientific theory, so that its primary and secondary

> principles can be clearly distinguished, it is rather likely that a statement asserting the reality and nature of configurations will be revealed as its sole primary principle or postulate. The present work, on the other hand, undertakes to demonstrate that the response of organisms to stimulus configurations is logically secondary, that it is the result of a rather complex process of learning which is mediated by the behaviorally primary processes of (1) afferent neural interaction, (2) perseverative stimulus traces, (3) reinforcement, (4) generalization of reaction potential, (5) experimental extinction, and (6) generalization of inhibition.[50]

These statements indicate that Hull's position cannot be interpreted in such a way as to suggest that the gap between behaviorism and field theory is being narrowed. Hull's previous statement that important differences between the two positions no longer exist is apparently based upon an inadequate interpretation of the implications of field theory. The similarity which Koch or McConnell see in the two systems is based upon acceptance of such phrases as stimulus generalization, neural interaction, or patterning of stimulus compounds, as no longer requiring the reflex arc concept. However, the use which Hull makes of these phrases requires this concept in order to provide an adequate foundation for his postulates.

50. Ibid, p. 379, Notes.

One additional example of an application of Hull's principles to a complex learning situation will be sufficient to indicate his position. In a magazine article published in the Psychological Review, Ralph White[51] takes a position opposed to that of Hull and states his reasons by discussing the following illustration. He poses a hypothetical situation in which an individual is confronted with a problem-solving, purposive choice. He describes a situation in which a hungry person is repeatedly placed in a two-choice maze; one path (B) leads to water, and the other path (C) leads to food. Neither the food nor the water can be seen, smelled, or otherwise perceived by the person at the starting point. The person learns the maze when hungry and in search of food. He learns to differentiate between the two paths during the early stages of his learning and acquires the knowledge that B always leads to water and C to food. White reasons that, after an individual has learned to go directly to the food, the same person would go without hesitation to path B to secure water if he is placed in the maze when thirsty instead of hungry.

51. Ralph K. White, "The Case for the Tolman-Lewin Interpretation of Learning," Psychological Review, 1943, pp. 157-186.

Under the organization of the experiment the response (path C) has been the only one that has ever been rewarded and thus reinforced, according to Hull's theory. White believes that Hull's principle of reinforcement means that the person would persist in taking path C under the changed conditions, at least for the first trial or so. White is confident that such persistence would not occur, under the described conditions, and that therefore Hull's principles can not explain adequately this assumed shift in behavior.

One of the numerous experiments which Hull reports in his text involves training rats in a problem situation similar to that proposed by White. Rats were trained in a two-choice maze situation to go directly to water when thirsty and directly to food when hungry. Hull states that "the animals of the experimental group gradually attained a considerable power of making the reaction which corresponded to the drive dominant at the time."[52]. Hull includes the data from this experiment as evidence of the principle of primary reinforcement as applied to motivation and "reactional potential." In the section of the text wherein he deals with the patterning of stimulus compounds he sets up a choice situation which involves behavior of human beings. He writes,

52. Clark L. Hull, op. cit., p. 234.

> ... For example, a red light suspended over a street intersection will cause a man to halt when his goal would lead him to cross the street, but a red light in a drugstore window will not cause him to even slow his pace; he responds not to the red light alone, but to it as a component in a particular combination of stimulus aggregates. Now, as a rule, learning to react, or not to react, to a stimulus combination as distinquished from its components is more difficult than the simple conditioning of a reaction to a stimulus compound. This learning to respond to stimulus combinations or configurations, as such, we shall call the patterning of the stimulus compound in question.[53].

The summary of his discussion regarding the patterning of the stimulus compound shows his analysis of the problem on the basis of his previous assumptions. It is,

> This type of learning by organisms turns out upon analysis definitely to be a derived or secondary phenomenon, dependent upon a number of logically prior principles all of which have been recognized by Pavlov. Among the more important of these are the combination of the reaction (R) to the afferent impulse (s) set in motion by the stimulus (S), rather than directly to the stimulus; the mutual interaction of afferent impulses; and the downward slope of the gradient of generalization both for excitation and for inhibition. For the derivation of temporal stimulus patterning there is required, in addition, the principle of the perseverative stimulus trace.
>
> When stripped of quantitative details, the basic logic of stimulus patterning is rather simple. The afferent impulses produced by the components of a

53. Clark L. Hull, "Principles of Behavior" p. 350.

> dynamic stimulus compound are to some extent different when the component is acting "alone," i.e., in a relatively static combination, than when it is acting with the remainder of the stimulus compound. If a reaction is conditioned to the compound, the reaction potential of a given component, because of the generalization gradient, is less when it is acting separately than when in the compound. During the differential reinforcement which produces this kind of learning, the generalized excitatory potential of the components is extinguished, developing inhibition in proportion to the reaction strength of each component. This inhibitory potential generalizes back upon the compound but, again, with a reduction due to the generalization gradient. The resulting net loss to the reaction potential at the command of the stimulus compound is much less than its original reaction potential; this ordinarily leaves the stimulus compound an amount of effective reaction potential which is well above the reaction threshold. This difference is the basis of the discrimination, i. e., of successful patterning. ....[54]

These principles applied to the original choice situation which involve different responses to a red light as an element in different situations make the explanation go somewhat as follows. During the learning process (differential reinforcement) a change occurs in the reaction potential of the compounds so that the stimulus compound which includes a red-light-at-an-intersection in a cross-the-street situation has a different reaction potential than either a red light by itself or a red light in any other

54. Ibid, pp. 376-377.

situation. This difference in potential which is due to a particular combination of stimulus aggregates will result in discriminatory choices. The crucial part of this explanation is the learning process, the point at which differences in potential are assumed to be established. For Hull the process is dependent entirely upon the principle of primary reinforcement which, as indicated previously, is based upon a reflex-arc type of connection between stimulus and response. Insightful, purposive behavior is explained on the basis of a complex arrangement of such connections.

Hull regards his explanation of this type of learning as "rather simple." However, if one attempts to derive principles of learning from such explanation for practical use in ordinary classroom situations, one is confronted with complication rather than simplicity. One must assume, at first, that learned behavior is reducible to single units of relatively fixed stimulus-response combinations. Such a concept appears to offer a simple explanation for behavior. But when one attempts to apply this concept to complex forms of behavior an extremely complicated description is necessary. Hull's explanation (quoted above) is an example of such. That description does not offer a principle of learning which is easily grasped. Use of such terms as "differential reinforcement," "inhibitory

potential," "generalization gradient," etc., makes Hull's description difficult to understand and his principles difficult to apply. It is only by reference to a fundamental concept such as the reflex arc that a degree of simplicity is apparently introduced. The adequacy of such a concept is examined in the following section.

### C. Adequacy of the Assumption that Learning is Dependent Upon a Condition of the Synapses.

Data which bear directly upon this issue come mainly from animal experiments in which normal paths of nerve impulse conduction are disturbed by means of a surgical operation. Pre-operative performance of the animal is compared with its post-operative performance to determine what significant changes, if any, can be attributed to interference with nerve impulse conductors. Some of the more significant experiments of this type have been performed by K. S. Lashley. Results of these experiments have been published in several magazine articles and in Lashley's book, "Brain Mechanisms and Intelligence."

One of Lashley's experiments deals with "The Retention of Motor Habits after the Destruction of the So-called Motor Areas in Primates." The right precentral gyrus of a cebus monkey was destroyed by cauterization. Severe paralysis of the left arm and leg followed. The animal

was then trained to open a variety of latch boxes with his right hand. The left arm was practically useless in the performance of these activities and was used merely as a prop. After successful mastery of the various latch box problems the left precentral gyrus was cauterized and a paralysis of the trained right hand followed. The animal then gained proficiency in the use of his left hand in various activities, none of which involved, however, opening the latch boxes. As soon as the experimenter believed that the right hand had recovered sufficiently to be used in the manipulation of the latches, the monkey was presented again with the various latch-box problems. The animal opened the boxes efficiently with his untrained left hand. Lashley describes the results as follows,

> When confronted with the problem boxes he fumbled clumsily at the catches of each during a few trials with his right hand, then attacked the fastenings with his left hand and released them without random movements and almost as quickly as he had formerly done with his right hand after protracted training. There was almost perfect transfer of the habit to the hand which had been paralyzed during training.[55].

55. K. S. Lashley, "Studies of Cerebral Functioning in Learning: VI. The Theory that Synaptic Resistance is Reduced by the Passage of the Nerve Impulse," Psychological Review, 1924, p. 373.

The rapid and successful use of the left hand in this performance cannot be explained satisfactorily by a learning theory which depends, as a primary principle, upon repetition or reinforcement of neural connections. An explanation of the original learning to manipulate the latches with the right hand might conceivably indicate such a process. But adaptation of previously unused neural pathways without opportunity for building connections eliminates the assumption even as a possible explanation for the original learning. As Lashley points out, the behavior of the monkey indicates a type of habit formation "which cannot be explained by any wearing down of synaptic resistance through the passage of nerve impulses."[56].

These data were established prior to Hull's formulation of his principles of behavior. Yet, in his article which deals with the conflicting theories of learning, Hull[57] makes no reference to Lashley's work. The text, "Principles of Behavior," contains two references to one of Lashley's experiments, but neither deals primarily with the issue of synaptic resistance as related to behavior.[58].

56. Ibid, p. 374.
57. Clark L. Hull, "Conflicting Theories of Learning -- A Way Out," Psychological Review, 1935, pp. 491-516.
58. Clark L. Hull, Principles of Behavior, p. 189 and p. 218. On page 189 Hull refers to an experiment on "The Mechanics of Vision: XV. Preliminary Study of the Rat's Capacity for Detailed Vision" reported by Lashley. Hull comments, "When numerous physical dimensions are mixed in various ways and, particularly, where interaction occurs between different parts of the retina, the the nature and amount of the generalization effects are extremely difficult to predict, as the extensive experimental investigations of Lashley have shown."

Thus Hull appears to disregard available data which are relevant to the basic assumption underlying his theory of learning. If reinforcement is required to insure learning, an explanation of the monkey's ability to use his untrained left hand successfully is impossible. Neither does Hull's law of neural interaction explain this behavior, since the monkey's left hand was paralyzed during the learning trials. None of the neural pathways in the left arm received reinforcement nor were they affected in any conceivable way by neural interaction, and yet the animal used his left hand successfully the first time a confronting situation arose which required such use.

A more comprehensive group of experiments performed on rats was conducted by Lashley. In general, these experiments involved the training of rats in a variety of problems both before and after the destruction of parts of the cerebral cortex. The lesions were within the "association area" of the cortex and the animals were tested to determine the influence of such interference with possible association pathways upon previously learned habits or upon their ability to learn and retain new habits.

Lesions were made within the auditory region, the somesthetic region, the visual area, and the motor region of the cortex. Definite efforts were made to localize a learned pattern of action such as the ability to discriminate

varying degrees of light brightness or ability to run a maze successfully. The data which Lashley presents show that the size of the lesion has much more relationship to the learning and retaining ability of a rat than does the location of the lesion. Specifically, he states,

> First, for some problems, a retardation results from injury to any part of the cortex, and for equal amounts of destruction the retardation is approximately the same. The magnitude of the injury is important; the locus is not. Second, there may be a general retardation, arising from any injury, to which is added a specific retardation resulting perhaps from sensory deficiency and associated with lesion to a particular cortical field. Third, for still other habits there may be a complete absence of any effect upon learning from lesions of any extent or of any locus, within the wide limits of these experiments. The second of these types, based upon Maze IV, is no more than suggested by the results of these experiments but seems pretty well established by much clinical work with man. The first and third are clearly established in these experiments.[59]

With respect to the functioning of the association area in the development of specific habits, Lashley concludes,

> We thus have evidence that the maze habit is not interfered with by any purely sensory or motor defect, that the formation of a sensory habit is not retarded by absence of the corresponding cortical sensory area, and that the deterioration following lesions in different cortical sensory fields is qualitatively the same for all fields. All of this points to the

59. K. S. Lashley, Brain Mechanisms and Intelligence, p. 60.

> conclusion that defects of the maze habit are due to some general deterioration, which affects the associative mechanism as a whole rather than distinct, qualitatively different, elements of the habit.[60]

Lashley discusses the assumption that behavior is dependent upon changes within the synapses. In his experiments, he points out, the operated animals learned more slowly. If learning is due to synaptic changes there is no reason to assume that a habit finally learned by the operated animals would be any less stable than one learned by normal animals. However, the maze habit was lost more rapidly by the operated animals than by normal ones and to an extent somewhat proportional to the amount of cerebral destruction. Lashley concludes,

> This can only mean that the retention of the habit is conditioned by the total amount of functional tissue in the cortex, and not, primarily, by the inherent properties of the synapses themselves.[61]

Data from Lashley's experiments have unusual significance for the present problem because of the bias with which he began his work. His association and study with Watson had trained him in a thoroughly behavioristic approach to a theory of learning. In a brief discussion of the relation of this theoretical background to his experiments he writes,

60. Ibid, pp. 118-119.
61. Ibid, p. 126.

> The great majority of recent discussions of learning in animals have developed under the influence of the doctrine of random activities and the elimination of useless movements, isolated save for simple associations with the preceding and subsequent links of the chain, as simple concatenations of conditioned reflexes. Such a view precludes any attempt to relate the findings from studies of animal learning with human insight or reactions to relations. ...
>
> I began the study of cerebral function with a definite bias toward such an interpretation of the learning problem. The original program of research looked toward the tracing of conditioned-reflex arcs through the cortex, as the spinal paths of simple reflexes seemed to have been traced through the cord.[62].

He goes on to point out that the data from his experiments do not agree with his original assumptions. They point, rather, to an entirely different conception of the relation of the nervous system to learning. Continuing, in summary,

> The experimental findings have never fitted into such a scheme. Rather, they have emphasized the unitary character of every habit, the impossibility of stating any learning as a concatenation of reflexes, and the participation of large masses of nervous tissue in the functions rather than the development of restricted conduction paths.
>
> Likewise, attempts to analyze the maze and problem-box habits in terms of adequate stimulus and conditioned-reflex responses have indicated that the problem is far from solved by the simple mechanical theories of learning. Random activity,

62. Ibid, p. 14.

> association, and retention constitute only a small part of the totality of processes underlying the formation of such habits, and even with the rat there is more than a little indication that direct adaptive reactions and some process of generalization are of fundamental importance for the learning process.[63].

Lashley's analysis of the implications of his work leads him to doubt the basic assumption of the reflex arc. It is necessary to point out that the scope of the experiments which he conducted does not include a direct attack upon the question of spinal reflexes, yet he states,

> I am coming to doubt the validity of the reflex-arc hypothesis, even as applied to spinal reflexes. There are many indications that the spinal reflexes are no more dependent upon isolated conduction paths than are cerebral functions.[64].

Other significant experiments which disturb normal relationships of the neural structure of an organism are discussed by Kurt Goldstein in his text "The Organism." He cites two types of experiments which are specifically focused upon the problem of the adequacy of an assumption regarding the relation of synaptic changes to behavior. One type involves transplantation of nerves and muscles, thereby making connections other than those which originally

63. Ibid, pp. 14-15.
64. Ibid, p. 163, footnote.

existed. He presents the results of several such experiments and summarizes the data thus:

> If we wish to obtain an understanding of how the new innervation is brought about we must concentrate on the fact that correct innervation is not the result of practicing, but that the very first performance is already correct. This fact precludes the hypothesis of newly formed tracts, or the training of tracts which were formerly not used.[65].

The second type of experiment involves the amputation of one or more of the extremities of an animal and observing the behavior which follows. Goldstein summarizes the data from such experiments as follows:

> The most important aspect of these significant experiments is, for us, that the shift to the new gait takes place correctly in the first attempt of the animal. This means that a complete change of the distribution of excitation in a large part of the organism takes place as soon as the demand of a performance requires it. This becomes particularly impressive when the new locomotion is of an entirely novel kind, never used before, as the experiment by Fischer especially shows. All the legs of a guinea pig were amputated. Soon after awakening from the anaesthesia, the animal began to roll around its longitudinal axis. Rolling was now the only means of locomotion.[66].

65. Kurt Goldstein, The Organism, p. 229.
66. Ibid, pp. 233-234.

It is obvious that this type of animal performance is much different from that of human beings who learn nonsense syllables. The significance which these experiments have for the problem of rote learning is due to the direct relationship which, from the connectionist point of view, exists between complex behavior such as motor performance and simple behavior such as rote learning. A complex learned act must, it is assumed, be built up by "tying together" a series of previously existing connections. Thus if a complex learned act can be shown to be independent of any conceivable arrangement of simpler connections, the possible existence of such connections is brought into question.

The significance of such experiments is not limited, however, to a negation of an assumption of neural connections. The data show also the need for a basic assumption, different from that proposed by an absolutist, to explain the functioning of the nervous system. This assumption is to the effect that the nervous structure of an organism will always function as a whole, and that the performance which can be expected will depend upon the nervous structure available, the objectives of the organism, and the confronting situation. These three factors will determine performance rather than specific neural pathways. Continued successful performance after destruction or artifical

switching of nerve structure indicates the necessity for assuming that the organism must be considered as a whole. Goldstein presents these assumptions as follows:

> Surveying all the facts in question we are led to a statement of the following general rules:
>
> (1) In case of impairment of a performance field, those performances tend to survive which are most important or necessary with regard to the functioning of the whole organism.
>
> (2) As long as it is possible that the needs of the total organism, with reference to a special performance field, can be fulfilled in the usual way, so long will the premorbid modus operandi be maintained. If this is impossible, an adjustmental shift occurs, conforming in principle to the first rule.
>
> (4) Finally, we must call attention to a particularly important factor. The shift occurs suddenly. It is not a result of training, and it happens without knowledge of the patient.[67]

Both Lashley and Goldstein present data from experiments which involve direct interference with normal paths of nerve impulse conduction in animals. Adrian and Forbes conducted a different type of neurological experiment, data from which are pertinent to the present study. These experimenters attempted to test the reasonableness of the all-or-nothing principle when applied to sensory nerve fibres. The all-or-nothing principle states, in effect, that a stimulus which is capable of bringing about excitation at all brings about just as intense excitation as any

67. Kurt Goldstein, The Organism, p. 51-53.

stimulus of greater or lesser strength. Adrian and Forbes present an early series of experiments which indicate that the strength of a nerve impulse is reduced during passage through a narcotized section of nerve fibre. They organized an experiment in which "stimuli of different strengths are applied to the proximal end of a nerve and the impulses set up are allowed to travel into a narcotized area."[68] They then tested the strength of the impulse, if any, which carried to the opposite end of the nerve.

Their discussion of the results of the experiments is as follows:

> As the electric response becomes smaller, the strength required for a minimal response remains constant or rises, and that required for the maximal response falls. These changes are readily explained by the early failure of some of the fibres, which may happen to be either the most excitable or the least excitable in the nerve. But the important point concerns the strength of stimulus which is effective just before the complete failure of conduction. In Fig. 9 this is no greater than the original threshold value. Thus the stimulus which remains effective until complete failure is one which was originally only just strong enough to

68. E. D. Adrian, and Alexander Forbes, "The All-Or-Nothing Response of Sensory Nerve Fibres," Journal of Physiology, 1922, p. 312. The "all or none law" is still accepted as representing an accurate description of the functioning of nerve fibres. It is included in one of the most recent texts on physiology, namely, "The Physiological Basis of Medical Practice" by C. H. Best and N. B. Taylor. (4th Editon, 1945, pp. 785-786.)

> produce any effect at all, so that the impulse which it sets up can withstand just as great a decrement as the impulse set up by a stimulus many times as strong. This can only mean that the size of the impulse does not depend at all on the strength of the stimulus.[69]

Later they conclude that,

> Impulses set up in the internal saphenous by stimuli of different strength are all equally capable of passing through a narcotized region, and when conduction fails for an impulse set up by a weak stimulus it fails also for a strong stimulus. The size of the impulse is therefore independent of the strength of stimulus in the sensory as in the motor fibre.[70]

The foregoing evidence relative to the functioning of the all-or-nothing principle in the nervous system is contrary to any assumption intended to explain behavior on the basis of varying synaptic resistances. Any change within a synapse which increases or lowers its resistance to passage of nerve impulses would be similar to the change artificially produced in Adrain and Forbes' experiment. Since the size of the impulse is not changed noticeably by passage through resistance within a nerve, it is unlikely that synaptic resistance could noticeably affect nerve impulses. The assumption that repeated

69. Ibid, p. 313.
70. Ibid, p. 339.

passage of nerve impulses across a synapse alters it in such a way as to induce resistance changes offers no explanation for learning in the light of such data. Watson recognized the implications of the all-or-nothing law for his conception of the function of a synapse in the neuro-physical basis of action. He states, "If the all-or-none law is established the conception of the synapse will have to be modified.... If the various implications of the law are confirmed it will probably profoundly modify many of the present conceptions of neurophysiology."[71].

Application of the all-or-nothing principle implies that varying degrees of response strength are dependent upon the total number of fibres stimulated rather than upon the intensity of stimulation. Thus, if a muscle makes a response equivalent to one-third its capacity approximately one-third of its fibres have been stimulated. Adrian and Forbes interpret their data in such a manner when they note that changes in the strength required for a minimal or maximal response are "readily explained by the early failure of some of the fibres."[72]. Thus the reasonableness of the all-or-nothing principle is

71. John B. Watson, Psychology From the Standpoint of a Behaviorist, pp. 119-120.
72. E. D. Adrian, and Alexander Forbes, op. cit., p. 313.

demonstrated at least for the particular parts of the nervous system investigated in the above experiments. Extension of this principle to all phases of neural conduction is warranted in view of the lack of data to the contrary.

Data from the foregoing neurological experiments conflict with the assumptions which Hull makes to explain learning. The law of reinforcement has meaning only if synapses are changed during a reinforcing process so as to reduce or increase resistance to subsequent passage of neural impulses. Application of the all-or-nothing principle to neural conduction involved in learning precludes the possibility that such resistance, even if developed by a reinforcing process, would have any appreciable effect upon behavior. Hull's description of the process of developing purposive, intelligent responses to situations requires an assumption such as the reflex arc in order to make it understandable. Such an assumption is questionable in light of known neurological data. For these reasons Hull's law of reinforcement appears to be inadequate as a basis for an explanation of the learning process.

It is equally significant that data to support the assumption required by Hull's theory are lacking, to date. Investigations are under way with the electroencephalograph

(EEG) which, in the future, may shed light upon the nature of cortical activity. The EEG is an instrument designed to record various types of electrical activity on the surface of the brain. A normal record is indicated by a series of rhythmical waves, several of which can be isolated and identified for special study. One of these, called the occipital alpha rhythm, has been "conditioned" in the laboratory by Jasper and Shagass.[73]. They demonstrated that this particular rhythm will be depressed whenever a flash of light appears suddenly infront of a subject. They selected another activity, clenching the fist, which had no appreciable effect upon the alpha rhythm, and by traditional conditioning methods were able to produce a depression in the brain wave as a result of clenching the fist alone.

Use of such an instrument in this manner has been regarded by some as offering considerable hope for finding neurological data which conform to conditioning hypotheses. However, to date use of the EEG has not yielded such data. Knott discusses the status of the contributions which this type of research has made and indicates that insufficient knowledge of the use and interpretation of the EEG record precludes definite conclusions at this time.

73. Herbert Jasper and Charles Shagass, "Conditioning the Occipital Alpha Rhythm in Man," Journal of Experimental Psychology, 1941, pp. 373-388.

In the summary of his article, he writes,

> The just preceding review of some of the data obtained by the EEG technique (those which seemed to the author to have the greatest bearing on the problem at hand, but which, as far as is known, are not contradicted by other data) would seem to indicate that, while there is a lack of finality about them, they carry with them suggestions of new paths of research, of new interpretations of events intervening between "S" and "R."
>
> The fact that the EEG partially opens the door which has long been locked upon the central nervous system is fairly certain to make some imprint, even though it be initially faint, upon psychological theory; for what can be deduced about the functions of the nervous system from evidence provided by this particular technique, and especially by judicious combinations of techniques, shall have to be considered when hypotheses regarding neural events are being formulated or when more formal theories are seeking referents for their postulates.[74]

For the present, then, this research offers no confirmation to the hypothesis basic to conditioning theory, namely that behavior is dependent upon changes within the synapses.

Other considerations, aside from neurological data relative to the function of the synapses in behavior, indicate the inadequacy of conditioning as a theory of learning. Certain problems which involve varied reactions

74. John R. Knott, "Electroencephalography and Physiological Psychology: Evaluation and Statement of the Problem," Psychological Bulletin, 1941, p. 974.

based upon discrimination of meanings within a pattern of stimuli cannot conceivably be explained by a system of fixed-in-advance neural pathways. Such problems are of the general type which Hull mentions, that of varied responses to a red light in different situations.

Kurt Koffka poses a problem of this type which is sufficiently different from Hull's example to warrant discussion. Koffka describes the behavior which ensues when an individual perceives an object such as a stone flying through the air. Koffka reasons that by reflex-arc hypothesis the behavior which results is determined entirely by the impulses which are set in motion by the reception of object stimuli upon various parts of the retina. The reception of the stimulus cannot conceivably be affected to any great degree by the velocity of the stone. And yet is well known that an individual's response to such a situation will depend largely upon both the velocity and the direction of the stone. Koffka explains it in these words,

> ... In the first place, the position of the stone at the critical moment by no means determines the stimulated point of the retinae. This depends also upon the position of the eyes at the moment. And yet, the response may be independent of this position of my eyes; I will step aside, whether I had previously looked straight at the stone or at an object to its left or right, above or below, in front or behind it. Practically every

> point of the retina will, in this manner of speaking, be connected with the same reaction. In the second place, the same retinal point will lead to different reactions, including no reaction at all, according to the whole path and the velocity of the flying stone.[75].

By diagram he illustrates the different possibilities of response depending upon the direction of the flight of the stone. In order to avoid the missile an individual may step either to the right or left or may stand still. Koffka describes the relation of this phenomenon to an assumption such as the reflex arc. He writes,

> Thus the strict application of the simple reflex arc theory is impossible. Any modification would have to accept motion as a stimulus, that is to say not motion of the external object, nor even motion of the retinal image, but motion as a process within the brain. But this modification is tantamount to a complete abandonment of the original reflex-arc hypothesis, since it has replaced the excitation in the afferent branch by a process in the brain, and has thereby destroyed the whole concept of connectionism.[76].

Some of the laboratory experimentation in the field of conditioning yields data which do not fit the basic assumptions of conditioning. D. D. Wickens[77]. reports an experiment, for example, which followed the traditional

75. Kurt Koffka, Principles of Gestalt Psychology, p. 370
76. Ibid, p. 371
77. D.D.Wickens, "Studies of Response Generalization in Conditioning: I. Stimulus Generalization During Response Generalization," Journal of Experimental Psychology, 1943.

conditioning procedure with a group of college students. An electrical shocking device was used on which each subject placed his hand, palm down. When electricity was applied the subject was able to terminate the shock by raising a finger off the contact point. An electrical shock was the unconditioned stimulus; the extension of finger muscles was the normal response. The students were conditioned so that the sound of a tone, by itself, brought the finger extension response. After thorough conditioning to the new stimulus each subject turned his hand over, palm up, and placed it in the shocking apparatus. In this situation the finger had to be flexed rather than extended to raise it from the contact point. The tone was sounded and for the group as a whole the response was characteristically flexion rather than extension.

Several groups were tested under the changed conditions by varying the pitch of the tone from that to which they were originally conditioned. The flexion response appeared when the pitch was varied. Wickens recognizes the implications of these data as follows:

> The results of the experiment militate against the narrow interpretation of conditioning previously referred to, for not only is the form of the response different from the one that was originally trained, but this generalized response may be evoked by other stimuli

> than those that were used in the initial training. Neither is the conditioned response in this situation stereotyped in form, nor is the varied form of the response uniquely tied to the original conditioning stimulus.[78]

Koffka's discussion points to the inadequacy of contioning theory as an explanation of complex behavior, while Wickens' experiment deals with what are ordinarily called specific habits. Supporters of conditioning theory frequently claim that it is particularly useful to explain so-called simple behavior such as formation of specific habits or skills. McConnell, Burton, and Risk each include conditioning principles because of this belief. Thoughtful consideration of such behavior leads one to doubt whether it is as simple as is claimed. Any specific habit, as hitting a ball, becomes more and more complex the more it is analyzed. A safe hit on the part of a ball player is never, under any conditions, the result of a fixed chain of responses. Each ball pitched represents to the batter a stimulus in a setting uniquely different from any previous situation. To say that any part of the skill of batting represents a simple arrangement of fixed stimulus-response sequences is to disregard the numerous variations and resulting complexities which are apparent upon analysis.

78. Ibid, p. 226.

Breaking down skill performance into its component parts does not necessarily make the part any less complex than the complete act. Specific habits are therefore not fixed sequences of acts but are extremely variable forms of behavior. This phase of behavior is complex, then, rather than simple and conditioning principles are as inapplicable to formation of specific habits as they are to purposive, intelligent behavior.

The ability of contemporary conditioning theory, as proposed by Hull, to explain learning depends upon the usefulness of the assumption that behavior is dependent upon changes within the synapses. This assumption has been shown to be inadequate because (a) it conflicts with known neurological data, (b) it does not explain complex forms of behavior, and (c) so-called simple forms of behavior such as habits and skills are in reality complex and apparently require principles similar to those required by purposive, intelligent behavior. Thorndikian connectionism and Hull's conditioning principles are alike with respect to their assumptions regarding the relation of the nervous system to behavior. For the reasons indicated, neither of these two systems appears to offer an adequate basis for development of a theory of learning.

# CHAPTER VI

## LEARNING AS THE DEVELOPMENT OF INSIGHT

The third major question to be considered is the possibility of applying to all phases of learning the principles which state that learning is a sensing of relationships. The data which have been presented in the discussion of the previous questions indicate that such principles are necessary to explain the learning common to complex forms of behavior. This is the viewpoint held also by those who suggest some form of continuum for principles of learning.

The issue yet to be discussed revolves around the question of whether it can be shown that the type known as rote learning requires a sensing of relationships in order that the material may be learned. If the task of learning nonsense syllables, for example, can be shown to depend upon a process of establishing relationships, then principles derived from a relativistic conception of learning may be considered more adequate than any of the principles previously considered in this study of contemporary theories.

As compared with the amount of experimentation which elaborates various features of conditioning psychology, there is a relative scarcity of laboratory experimentation which attacks this problem directly. This is due in part to the fact that conditioning procedures can be easily

adapted to a laboratory where control of all variables save one is considered desirable. It is evident to an intelligent observer, however, that ordinary problem situations which occur in the classroom cannot, in general, be adapted for laboratory experimentation. Thus laboratory experimental situations and classroom situations do not ordinarily have much in common. This fact should be recognized when suggesting application of principles derived from laboratory experiments to classroom learning activities.

It has already been pointed out in the section of this study which contrasts the relativistic and absolutistic views of psychology, that laboratory experimentation, with human beings at least, probably does not achieve as rigid control over all factors as is considered desirable, or as rigid as is assumed in much interpretation of the data. This has particular significance in experiments which deal with learning such material as nonsense syllables, but it also affects the results when meaningful material is used. This is shown in a recent experiment reported by L. Postman and W. L. Sanders.[1]

1. L. Postman and W. L. Sanders, "Incidental Learning and Generality of Set," Journal of Experimental Psychology, 1946, p. 163.

The subjects were divided into six groups, each of which read, under different instructions, a 350-word excerpt from Tchekov's short story "The Bet." The first group was told that the experimenter was only interested in determining their speed of reading. They were given no specific instructions to learn. The second group was told that they would be tested in general comprehension. The remaining groups were told that they would be tested, respectively, for specific sequence of individual events, for details of content, for details of wording, and for details of physical appearance. All groups actually were tested on their performance on each and all of the five types of tests listed. Comparison of the performance of these different groups, learning under different mind-sets, led the experimenters to conclude that,

> Our results confirm the hypothesis that learning and memory are never restricted to those materials which the subject has been instructed to learn...[2].

The subjects apparently used "explicit self-instructions," which must always be considered to some degree when active human beings are involved, since this factor may greatly affect the experimental results. Because it is assumed to have been controlled by the given instructions, this factor

2. Ibid, p. 163.

is rarely if ever mentioned in ordinary conditioning experiments. It is particularly important in experiments dealing with rote learning. The pattern of learning which the experimenter intends to have his subjects follow at a given time may be extremely difficult because of the unusual nature of the material. The subject may, by self-instruction, shift his procedure to one entirely different from that which the experimenter intends, whereas interpretation of data is, in most reports, based upon the organization and procedure which the experimenter believes the subject followed.

A. Data from Rote Learning Experiments

In spite of the difficulty just illustrated, some experiments which deal with rote learning provide an indication of the principle required. The work of Katona comes perhaps as near to a direct attack upon the problem as any. In his book, "Organizing and Memorizing," the discussion centers around three alternative assumptions regarding the original or primary form of learning. These are:

1. Memorizing is the prototype of learning.
2. Understanding organized wholes is the prototype of learning.
3. Memorizing and understanding are distinct and independent learning processes.

> The author believes that the second thesis is correct. The objective of this book was to show that the first thesis is not valid. It cannot be proved here that the third thesis is wrong and that the second thesis is right. Such proof would require a detailed analysis of the extensive investigations on association, conditioned reflex, and the acquisition of skills in adults, children, primitives, psychopaths, and animals. It would be necessary to study how the implications derived from our knowledge of meaningful learning of human adults affects other types of learning processes. That can hardly be accomplished in this limited space. Therefore, we shall only show here that good reasons can be given both for the assumption of a common principle governing all kinds of learning activities and against the assumption that the two types of learning are entirely independent of each other. Organization will be shown as that common principle. ....[3].

Katona reports the results of several experiments of his own and cites data from the work of other experimenters in support of his position. His own experiments include some which involve learning nonsense syllables. In one of these he used six subjects who first learned twelve pairs of nonsense syllables such as "kem fap" on one day; twelve new pairs of words with numbers the next day, half of which used the second element of the previous pairings as the first element in the new pairings. For example, "fap 38" was one of the pairs learned the second day. Two days later the subjects were asked to name a number upon hearing

3. George Katona, Organizing and Memorizing, pp. 246-247.

twelve stimulus words. Six of these stimulus words were the first words of the pairs learned the first day. Out of a possible seventy-two responses there were only four when the number was given in its correct relationship to the first word of the sequence.

A connectionistic explanation of learning assumes that a neural connection is responsible for learning. If this assumption is applied to the learning situation described above, learning the sequence "kem fap" one day and the sequence "fap 38" the next day should form a connection between the syllable "kem" and the number "38." Inability of the subjects to perform in this manner suggests the necessity for another explanation regarding the process of learning this kind of material. As Katona points out, the syllable "fap" plays a role in the first group different from that in the second, and the learning which enables the subject to remember these relationships does not spread. Each group forms a unit which was organized by the subjects into a unique relationship. Knowledge about syllable "fap" which was acquired on the first day was of no use on the second day when the syllable appeared again. The relationships which are formed retain their specific nature.

Katona presents also the results of certain German experimenters -- Mueller and Schumann, and Witasek -- all of whom apply the principle of rhythmic grouping in reading nonsense syllables as a means of facilitating memorization. Data from these experiments, in addition to those from Katona's work, lead him to conclude as follows:

> Let us summarize the evidence here assembled with regard to the learning of nonsense syllables. Let us suppose that twenty syllables are presented in a vertical column on a sheet of paper. At first glance it does not look as though there could be any difference in the relationship between the syllables. Now the subjects begins to read aloud with the intention to learn. At the first repetition the accents are still rather weak, and the grouping is rudimentary. In later repetitions, however, the second syllable belongs to the first, the fourth to the third, and so forth (if the first, third, fifth, and so forth, syllables were accentuated). The material is then organized, and groups are formed as units which have their own qualities and localization. It appears that learning consists largely of the formation of such groups, in which one part tends to recall the whole group. Within a group the function of one part is affected by the group to which the part belongs. Thus, the application of the whole-part relationship to the learning of a series of nonsense syllables changes the usual assumption that with this material connections are established between neighboring syllables which are uniform and always of the same strength.[4].

4. Ibid, pp. 174-175.

Katona discusses next a different type of experiment which contrasts the effect of grouping according to an arrangement having artifical grouping. Grouping according to an arrangement consists of finding some pattern, suitable to the learning material, which will organize the material and hold true for the entire series. Artifical grouping often if not usually consists of learning by rhythmic accentuation of alternate syllables, or some similar device. He organized an experiment wherein the learning material consisted of the following sequence of numbers:

2 9 3 3 3 6 4 0 4 3 4 7
5 8 1 2 1 5 1 9 2 2 2 6

Four comparable groups of undergraduates were used under the following conditions. For Group I, the numbers were written as indicated and the subjects were told to learn the series. They were told that some special principle governed the particular arrangement of numbers. (Four added to the first pair will give the second pair; add three, then four, then three, then four. Three added to the first number in the second line will give the second number; then add three and four, alternately.) The subjects were not told the exact principle but they knew that the numbers were not in random order.

Group II was given the numbers written as follows:

293 336 404 347
581 215 192 226

The subjects were told to learn the numbers by grouping them in rhythmical order. Group III was told to learn the following specific facts regarding government finance. The members were asked to repeat aloud five times the statement that government expenditures were:

$2, 933, 364, 043.47 in 1929
$5, 812, 151, 922.26 in 1936

Group IV was given a short lecture on government finances and during the course of the discussion the following arrangement of numbers was placed on the blackboard and referred to frequently.

$2, 933 million $15, 192, 226, 000
$5, 812 million $36, 404, 347, 000

Each of the four groups was then asked to reproduce the twenty-four digits which had been presented under the described learning conditions. (The zeros in the last series were disregarded.) A first test was given shortly after the learning period. A second test was given three weeks later.

Considering both tests, the first group was superior in performance to any of the others. Group I was able to reconstruct the items; since most of the members had learned the principle which governed the arrangement of

the series of numbers. This type of organization of the learning material was superior for the experiment. The performances of Group II, which was asked to organize the numbers by rhythmical accentuation, and of Group III, which could organize the material according to the accepted method of grouping amounts of money, were almost equal to each other on the first test, considerably below that of Group I, and none of either group was able to reproduce the sequence at the time of the retest. Members of Group IV, for whom the job of organization was extremely difficult, were unable to learn the material within the limits of the experiment. Their performance was zero on both tests.

Katona discusses the relation of various types of grouping which may be used by subjects when learning nonsense syllables. He writes,

> Grouping of nonsense syllables was found to be much more general than it was originally assumed to be. It was established by several methods in addition to that of accentuation. In optical presentation and silent reading grouping was achieved if the time interval was increased regularly after certain syllables. Another method was to present each two syllables beside each other instead of one below the other in order to promote the formation of pairs. However, methods of testing seem to have influenced grouping in the learning experiments which followed the first tests. The method of paired associates, ... in which during the test the subjects are given every second syllable and are asked to

> reproduce the syllable which follows the given one, brings about in later learning experiments a grouping in pairs.[5]
>
> The grouping in which nonsense syllables are involved when learned is a grouping of a special kind, from which other kinds of grouping must be differentiated.... The quality of the part appears to have no influence on the form of grouping. Moreover, a series of syllables can be divided into a large or a small number of groups, since it can be learned in groups of two, three, or four syllables (groups of more syllables are unusual). With which kind of grouping one proceeds is arbitrary. The groups created are artifical products of an arbitrary procedure on the part of the learner.[6]

Katona also points out that similar conclusions are required in many of the experiments which Thorndike conducted. For example, in the word-number series (bread 29, wall 16, Texas 28) the subjects were asked to tell what number came after the word "bread" or what word came after the number "16". The fact that the word-number sequence was learned easier than the number-word sequence was probably due to the formation of groups in the word-number order. Thorndike recognizes this possibilty in part when he suggests that the better performance on the word-number sequence is due to "the way in which the words were read." [7]. The words were grouped with

5. Ibid, p. 168.
6. Ibid, p. 176.
7. E. L. Thorndike, The Fundamentals of Learning, p. 71.

numbers because of the method of reading. This approximates the type of grouping which Katona describes as rhythmical.[8].

In Thorndike's sentence series, the words which composed the sentences made up distinctly organized units. These relationships apparently promoted a degree of learning

8. Katona appears to include meaningless repetition or drill as a part of a complete description of learning processes. He gives (p. 233) a threefold division: Section A contains senseless connections which can only be memorized; Section B contains meaningful connections which can be learned either by memorizing or by understanding; and Section C contains meaningful connections which can be learned only by understanding, and not by memorizing. He states, "The concept memorization is used here in the sense of fixation of rigid traces by repetiton." (p. 234)
However, in the following paragraph he writes, "Fortunately, material which cannot be learned by understanding but only by memorizing is rather limited (except in psychological experiments). Later in this chapter we shall show that enumeration of specific data (facts, information), such as the birth dates of poets and the altitude of mountains, do not form always and necessarily 'senseless connections which can only be memorized.' The learning of most raw facts belongs to Section B, because it is due only to the lack of adequate organization that the connection between a battle and its date appears to be as senseless as the connection between a man and his telephone number." (p. 234)
His conclusions that organization is a requirement for successful memorization; that it must be present in some form in all kinds of learning; and that material which can be learned only by memorizing is limited, seems to indicate that his position predominately favors an assumption which stresses development of relationships as a requirement of learning, at least as far as classroom situations are concerned.

when the subjects heard the sentences read. Without such organization the learning would probably have been as ineffective as the connections between a last word of one sentence and a first word of the next. Similar organization undertaken by the learners is probable in Thorndike's experiments with word-number sequences, when learning pairs "with belonging" is contrasted with learning "neutral" pairs. The sequences which "belonged together" (as "twins 22, young 16") were capable of organization into meaningful units and learning was thus facilitated. Learning where such organization was difficult was practically zero in these experiments.

Lastly, Thorndike's experiments wherein he rewards the correct answer by speaking the word "right" and discourages an incorrect answer by speaking the word "wrong" show the possibility of similar organization in learning. Katona suggests that, rather than assuming the word "right" to produce satisfying after-effects which strengthen a connection, it is more probable that the word "right" changes the entire situation for the learner. The subjects are no longer confronted with an entirely senseless set of stimulations. The word "right" permitted and promoted grouping. Katona summarizes his analysis of the relation of organization to learning of nonsense syllables.

> We conclude that organization is a requirement for successful memorization. It must be present in some form in all kinds of learning. In some extreme cases, in which there is, not a lack of organization, but a minimum of organization, the parts (although connected with each other) are called independent units, because a weakly organized group is formed which exerts only a small influence on the parts of the group. Such is the case in memorizing nonsense syllables or telephone numbers.[9]

A more recent experiment reported by Reed[10] supplies data which show the effect upon learning of a logical versus an illogical method of organizing nonsense syllables. The learning material consisted of 42 cards, each of which had four unrelated English words on the face and a nonsense syllable on the reverse side. Six nonsense syllables were used, each of which represented a logical category to which one of the words on the face of the card belonged. The student's task was to learn the nonsense "name" of each card.

Two basically different procedures apparently were used by the subjects. One group noticed that the nonsense word "bep" appeared on the back of several cards which, on the front, contained names of foods. Until they were

9. George Katona, op. cit., p. 249.
10. Homer B. Reed, "Factors Influencing the Learning and Retention of Concepts," Journal of Experimental Psychology, February, 1946, pp. 71-87; April, 1946, pp. 166-179; June, 1946, pp. 252-261.

presented a card that contained names of foods but did not have the word "bep" on the back, they assumed that "bep" stood for the category of foods. They changed then to the correct category, that "bep" stood for vegetables. Establishing relationships in this manner was called logical learning in this experiment.

The other group apparently attempted to associate the word "bep" with the first word on each card and made no effort to form any other relationship. For them the nonsense syllable merely stood for three or four unrelated English words. This was called illogical learning and was much less efficient than the logical method.

Reed presents the results of the above experiment in three successive articles in the Journal of Experimental Psychology. The following includes the main points of his summary:

> A set to learn meanings as well as names yields a much higher rate of learning and degree of retention than a set to learn names only.
>
> Concepts logically formed are learned more quickly and better remembered than those illogically formed.[11].
>
> Complexity of stimuli has important effects on the kind and distribution of errors. Introducing confusing or conflicting concepts leads to the formation of concepts with double and multiple

11. Ibid, p. 86.

> meanings. As the complexity of the stimuli is increased there is a definite trend to shift from logical to illogical learning, or to base concepts on such factors as the primacy, frequency, and sensory similarity of contiguous stimuli.[12]

These data were not analyzed by Reed to determine in detail the exact nature of the learning process characterized as illogical. There is no reason to assume, however, that there was a complete lack of logicality on the part of the learners who used the so-called illogical method. The data show that learning is more efficient whenever relationships can be established which increases the meaning of elements to be learned. When such meaningful relationships are not apparent to a learner, he resorts to less efficient organization.

Further evidence of attempts of learners to organize learning material into meaningful units is found in one of the experiments conducted to broaden the principles of conditioning. In an experiment on "Generalization in the Initial Stages of Learning Nonsense Syllables," reported by B. R. Philip and Helen Piexotto, the subjects were required to learn three-letter, nonsense syllables which were presented in pairs. The experiment was concerned

12. Ibid, p. 261.

entirely with an analysis of the initial stages of this type of learning, the group never learning the pairs completely.

There were five different lists of these syllables, varying from four to twelve pairs on each. The pairs were of low associative value such as ZOF-GEX, YAV-WUQ, GEO-VAF. They were presented to the subjects, high school students, by means of film projection. With regard to the organization of the experiment the authors point out that,

> As a rule in experimental work on verbal material, learning is measured exclusively by the correctly reproduced and localized response, i.e., by the discriminated response... It is of course admitted that we are departing from the general usage when we take partial and inadequate responses[13] to indicate some form of learning.
> ... Since some form of learning is undoubtedly present almost from the very beginning, the study of these partial and inadequate responses will at least give some information in regard to the initial stages of the learning process.[14]

Analysis of these early responses led the experimenters to the following appraisal:

13. The authors differentiated between two types of responses. Partial responses were designated as "incorrectly reproduced." That is, a student might give ROS as the response to a stimulus instead of OSR. Correctly reproduced responses were called "integral."
14. B. R. Philip, and Helen Piexotto, "Generalization in the Initial Stages of Learning Nonsense Syllables," Journal of Experimental Psychology, 1943, pp. 136-137.

> A tentative description of the progress of learning is here advanced, based on the results of the learning curves in this experiment. Owing to the low association values of the syllables and the rotation of the recitation order, the learning was quite difficult. Learning was far from complete and was not spread uniformly over all the syllables. At the outset, those syllables which were easiest, due to their serial location, pronunciation, similarity, associative value, etc., were first selected by the subject for learning, probably without formulated intention or even definite awareness of such selection.[15]

The early stages of rote learning, as indicated by this experiment, can be considered as consisting largely in giving special attention to organization. The fact that the pairs which best lent themselves to such organization were selected for first learning indicates that so-called rote learning proceeds on this basis.

These data provide evidence of the validity of the assumption that rote learning involves organization of the material to be learned into some sort of meaningful pattern. Evidence is not conclusive on whether there is zero learning in the complete absence of any type of organization on the part of the learner, but there are no data which conflict with this interpretation. Thus, the assumption of learning as the development of insight or

15. Ibid, p. 144.

sensing of relationships is applicable even to rote learning. Principles of learning which involve meaningless repetition of nonsense material are inefficient, if not entirely useless.

One additional phase of this problem is the consideration of data which, in order to give an adequate explanation of the phenomena, seem at first to require an assumption that some condition of the synapses controls behavior. Hull's experiment in which he trained rats to discriminate between a food goal and a water goal has already been mentioned. Spence and Lippitt[16] organized a similar experiment and secured results which they believe require a behavioristic explanation.

They used two groups of rats and trained them in a two-choice maze. The right alley of the maze led to water, and both groups were trained to secure water when placed in the maze after being deprived of water for a period of time. For the first group, food was placed at the end of the left alley during the time the rats were trained to secure water. Thus these rats learned the maze when both food and water were available. During the training of the second group no food was placed at the end of the left alley. These rats learned the maze when water only was available.

16. K. W. Spence and R. Lippitt, "An Experimental Test of the Sign-Gestalt Theory of Trial and Error Learning," Journal of Experimental Psychology, 1946, pp. 491-502.

After both groups had completely learned the maze (they were able to go directly to water when thirsty) they were placed in it with thirst satiated but with food motivation predominant. For this trial food was placed at the end of the left alley for both groups of rats. However, almost without exception, they continued to go to the right, although presumably they were now in search of food.

The authors reason that these data support Hull's principle of primary reinforcement. They base this reasoning upon the fact that the rats which learned the maze when food was present in the left alley did not find the food any quicker than the group which were trained when no food was present. Neither group was able to make an effective adjustment in behavior when in search of food rather than water. The authors question the "Sign-Gestalt" theory of learning, under the belief that this theory would predict an immediate and effective adjustment in the behavior of the rats.

Such a prediction, however, does not necessarily follow. The rats could be expected to go to the food directly only if they were aware of the significance of this choice in relation to their goal. The fact that such choice existed was obvious to the experimenter, but not necessarily to the rats. The training which they had

received was insufficient to produce such awareness. The rats had evidently learned to get what they wanted from the right-hand alley, and they had no way of knowing at once that this was not effectual when they wanted food.

B. Mechanization in Problem Solving

Behavior phenomena of somewhat similar nature are described by Abraham Luchins in an article, "Mechanization in Problem Solving,"[17] which deals with human learning. He reports a series of experiments conducted at all age levels in which the subjects were habituated to solving certain types of problems in a given way. A test problem was then introduced which could be solved by a method simpler that the one previously used. The simpler solution was rarely chosen, probably because the characteristic method of solution set up in the preceding problems was the only one which occurred to the subjects under the circumstances. Control groups, non-habituated, tended to solve the test problem in the simple manner.

One of the experiments consisted of describing on paper how to obtain a required amount of water by the use of three different-size jars as measures. In the

17. Abraham Luchins, "Mechanization in Problem Solving," Psychological Monographs, 1942, pp. 1-34.

first six problems the result could be obtained by filling the largest jar, then dipping out some of the water, once with the medium-size jar and twice with the small jar. For each of the six problems the water remaining in the large jar was the required amount regardless of variations in the size of the jar. The seventh and eighth problems could be solved by this method, but could also be solved by filling the medium-size jar and dipping out once with the small jar. The ninth problem could not be solved by the method applicable to the first six; it could be solved only by the more direct method. The tenth and eleventh problems could be solved either way.

Three groups were used in this series; one was given no specific instructions, one was told to write the words "Don't Be Blind" after working the sixth problem, and the third proceded directly from the first problem to the seventh.

The pattern of this experiment was duplicated in other problem situations. Maze tracing was used, in which the first six trials required an indirect route, the seventh and eighth could be solved by both an indirect and a direct tracing, the ninth could be solved only by a direct route, and the last two could be solved either way. Luchins used also a hidden-word problem in which a four-or-

five-letter word was hidden, without transposing the letters, in a series of ten or twelve letters. The last experiment reported employed a series of geometry problems for learning material.

The results were similar, regardless of the type of material used. In general, the experimental groups persisted in using the habituated method even when confronted with the possibility of a simpler solution. Luchins calls this the Einstellung, or E-Effect. All of the groups, who were told to write the words "Don't Be Blind" just before the test problem, were slightly better than the non-instructed groups in their ability to shift to the simpler method. The public school children were an exception, as the E-Effect seemed to persist even after they were given the warning.

Luchins considers several hypotheses as possible explanations of the E-Effect. He writes,

> I. Hypothesis of a general fundamental, mechanical tendency: if a response (activity A) is made several times in succession to a number of similar situations, there is a strong general tendency to repeat this response again in a succeeding similar situation. ...
>
> II. To repeat blindly a response is not a feature generally or fundamentally characteristic of human behavior.. The blind repetitive activity is not the result of a general fundamental tendency but is created by special factors in the situation.....

III. The E-Effects are not brought about by a mechanization but result from intelligent assumptions, from a kind of reasonable behavior.[18]

Luchins believes that the data do not support the first hypothesis, but that they do support the second and third. He questioned the subjects after the experiment to determine, if possible, why they had not seen and used the simple solution when solving the last five problems. Their answers indicate that they worked under various assumptions such as: (a) the experimental method is required since I have been given repetitive practice with its use, (b) this is probably a test of my ability to learn a given method quickly. I have learned the method now so I shall use it on all the problems, or, (c) the experimenter wants me to use this method for all the problems.

In a few of the cases no tendency to use the habituated method appeared when these individuals were confronted with the test problem. In fact, these subjects seemed surprised when shown that there was any other way than the direct method which they had used. Luchins believes that a difference in the attitude and approach to the problem might explain why some developed an E-Effect.[19]

18. Ibid, p. 28.
19. Ibid, p. 33.

The public school children who appeared to have the most difficulty in adjusting even when they were asked to write the words "Don't Be Blind," were asked afterwards what these words were taken to mean in the experiment. Answers such as the following were given: "'Don't Be Blind' means don't bother trying to find a method in each problem, just do what you did before"; "Don't be blind to the rule which solves all the problems."[20]. Luchins summarizes the implications of these statements as,

> They did not take DDB (Don't Be Blind) as a challenge to do some thinking of their own, to drop the habituated method in favor of a better one, or to see the possibility of solving the problems by the D (direct) method; their interpretation was contrary indeed.[21].

This failure to adapt to a changed situation does not require the assumption that learning is mechanical. The manner in which the subjects viewed the entire situation in which they were placed, the organization of relationships which they made, quite probably brought about the persistence of the previous method of solution. It is not likely that it persisted because of the stamping-in of neural connections.

20. Ibid, p. 18
21. Ibid, p. 18

C. A Theory of Memory.

Another important area of problems closely related to learning is that of memory or remembering. The present study of theories of learning has not included any reference to these problems as yet, however, some consideration of a theory of memory is relevant at this point in order to determine whether the theory of learning proposed by relativists is inconsistent with data from studies on memory or remembering.

A historical review of the attempts to explain memory is unnecessary for this purpose. Many explanations which have been offered depend upon an assumption of traces made in the neural structure of an organism. Remembering occurs, it is believed, when subsequent stimuli re-excite these traces. If a theory of memory requires such an assumption, then a theory of learning which does not assume the existence of specific neural connections (traces) will be limited seriously in its usefulness.

However, data are available which indicate that an assumption of traces for the purpose of explaining memory is unnecessary, if not unwarranted. Bartlett's book on "Remembering" deals with this problem directly. Five chapters of Part I contain reviews of experiments on remembering.

Bartlett rejected the use of nonsense syllables in the series of experiments which he conducted in order "to avoid as far as possible the artificiality which often hangs over laboratory experiments in psychology."[22]. Instead he employed meaningful pictures, graphic signs, words and stories. The material for the preliminary experiments consisted of a series of five picture post-cards each containing a representation of the face of a man. The faces "were sufficiently alike to render their grouping easy, while at the same time each face had definite individual peculiarities."[23].

Each subject was allowed ten seconds to look at each card with instructions to note "carefully as many of the characteristics of the faces as you can, so that later you may be able to describe the faces, and to answer questions about them."[24]. After a lapse of thirty minutes each subject described the cards in the order in which he judged them to have been presented. A week or two later, depending upon availabilty, this description and questioning procedure was repeated.

Bartlett's tentative conclusions drawn from these experiments are indicated in the following excerpts:

22. Frederick, C. Bartlett, Remembering, p. 47.
23. Ibid, p. 48.
24. Ibid, p. 48.

> (i) Even when material is arranged in a short series, is small in bulk and simple in objective structure, and when it is so given that an observer knows that he will be asked to describe it later, remembering is rapidly affected by unwitting transformations: accurate recall is the exception and not the rule.
>
> .....
>
> (vi) The transforming effect of affective attitudes increases with lapse of time.
>
> (vii) This tranformation of material, which is constantly illustrated in recall, occurs most frequently in connection with the details which individual interest tends to make salient, or psychologically clear.[25].

The material for the second series of experiments consisted of a story, an argumentative prose passage, or a simple drawing. Each subject "attempted a first reproduction usually after an interval of 15 minutes, and thereafter gave further reproductions at intervals of increasing length."[26]. Bartlett concludes from these data that,

> 1. It again appears that accuracy of reproduction, in a literal sense, is the rare exception and not the rule.
>
> .....
>
> 10. In all successive remembering, rationalization, the reduction of material to a form that can be readily and 'satisfyingly' dealt with is very prominent.[27].

25. Ibid, pp. 61-62.
26. Ibid, p. 63.
27. Ibid, pp. 94-95.

On the basis of data secured from the experiments described above briefly, and additional experiments of somewhat similar nature, Bartlett formulates a theory of remembering. In this discussion he deals directly with the assumption of traces inherent in earlier explanations. He writes,

> .... There is, of course, no direct evidence for such traces, but the assumption at first sight seems to be a very simple one, and so it has commonly been made.
>
> Yet there are obvious difficulties. The traces are generally supposed to be of individual and specific events. Hence, every normal individual must carry about with him an incalculable number of individual traces.....
>
> Now we have seen that a study of the actual facts of perceiving and recognizing suggests strongly that, in all relatively simple cases of determination by past experiences and reactions, the past acts as an organized mass rather than as a group of elements each of which retains its specific character.[28].

In a later reference he suggests,

> It now becomes possible to see that, though we may still talk of traces, there is no reason in the world for regarding these as made complete at one moment, stored up somewhere, and then re-excited at some much later moment. The traces that our evidence allows us to speak of are interest-determined, interest-carried traces. They live with our interests and with them they change.[29].

28. Ibid, p. 197.
29. Ibid, pp. 211-212.

Bartlett summarizes his position in these words,

> Remembering is not the re-excitation of innumerable fixed, lifeless and fragmentary traces. It is an imaginative reconstruction, or construction, built out of the relation of our attitude towards a whole active mass of organized reactions or experience,[30] and to a little outstanding detail which commonly appears in image or in language form. It is thus hardly ever really exact, even in the most rudimentary cases of rote recapitualtion, and it is not at all important that it should be so.[31]

A more recent book dealing with problems of memory has been written by David Rapaport entitled "Emotions and Memory." Data for this text have been taken from the fields of psychology, psychopathology, and psychoanalysis. Rapaport includes data from experiments with psychiatric patients on remembering pleasant and unpleasant verbal material; from Freudian theories of remembering and forgetting; from a study of the contributions of hypnosis; from a study of pathological memory phenomena, especially amnesia; and from direct experimental evidence related to visually perceived material such as the Rorschach test and recall of verbal material such as stories.

30. Italics not in the original.
31. Ibid, p. 213.

Rapaport discusses a theory of memory and points out that psychologists of the Gestalt school maintain that three types of memory theory have appeared. These are:

> (1) the type of theory according to which every memory function is based on mechanical association, and those memory phenomena which do not seem based on it but are complicated variations of it; (2) the type of theory according to which memory function is essentially based on mechanical association, but the association-mechanism is directed by additional organizing factors such as the "Gestalt-qualities" of the Graz school, the "determining-tendencies" of Ach, attitudes, feelings, emotions, and so on; (3) the type of theory according to which memory-function depends on meaningful and appropiate organization, and the common arbitrary associations are only an extreme case of minimal organization.[32]

Rapaport states that for Gestalt psychology only the third of these approaches is acceptable, but he considers the possibility that "a fourth and perhaps comprehensive theory of memory has been left out of consideration."[33] With this possibility in mind he summarizes his review of the contributions of psychological theory as follows:

> a. The material surveyed in this section shows that in the literature of psychological theory there was an ever-increasing realization that memory was not merely a process of mechanical imprinting on a wax plate, of retention or fading of this imprint, and of

32. David Rapaport, Emotions and Memory, p. 135.
33. Ibid, p. 135.

> isolated resuscitation of the material thus registered and retained. There appears to be considerable agreement that memory processes are subject to the activity of selective forces related to deep strata of the personality, and to the field conditions under which registration and remembering take place and which exist in the retention period.[34]

After his analysis of recent data from psychopathology and psychoanalysis, Rapaport submits the following formulation as representing his position:

> It has been said that Gestalt psychology has shown that the laws of memory of the Ebbinghaus type refer only to special cases of memories of minimal organization, and that the more general theory of memory is the theory built by Gestalt psychology on "meaning" and "organization." If this formulation is correct, the thesis of the new memory theory may be formulated thus: the memory laws based on logical "meaning" and "organization" of the memory material refer only to special cases of memory organization: the more general theory of memory is the theory based on "emotional organization" of memories[35] in other words, on the organization of memories by strivings. ..... The new theory does not disregard the fact that the meaningless, and the merely logically-meaningfull, also frequently become the subject matter of memory-functioning; but it maintains that these are extreme cases and frequently artifacts in a great continuum, the fundamental organizing factors of which are "emotional."[36]

34. Ibid, p. 136.
35. Italics not in the original.
36. Ibid, p. 268.

The foregoing conclusions from Bartlett and Rapaport show that a theory of memory is not dependent upon an assumption of traces. It is true that not all psychologists who have contributed to a relativistic conception of the learning process have omitted references to such an assumption in their explanations of memory. Koffka, for example, uses a trace concept to explain remembering. And, Bartlett's reference to "interest-determined, interest-carried traces" has already been included.

However, the tenor of Bartlett's conclusions as a whole do not imply any reference to such an assumption and indicate the possibility of explaining memory without it. Nothing can be found in Rapaport's analyses and conclusions which indicates any inconsistency between his findings and formulation of a theory of memory and the assumption that learning does not depend upon formation of specific neural connections in an organism.

The results of these varied types of experiment indicate that principles which explain learning as the development of insight do not conflict with the data, and explain them much more simply and understandably than do mechanical hypotheses. In rote learning there are strong indications that some form of organization on the part of the learner is required before learning can even begin. In situations where a learned method of procedure is continued even though

it has become inefficient because of a change in conditions, the learner is either unaware of the significance of the change or that a change exists. The reasons for this lack of awareness vary with the subject.

Learning as a process of sensing relationships offers a simple and reasonable explanation for the foregoing phenomena. The assumptions which underlie this concept are not intended to explain how nervous tissue acts to produce learning. They are intended, rather, to suggest a method which can be used successfully to cope with all kinds of learning. It is generally agreed among contemporary writers that such a concept is required to explain complex forms of learning wherein large numbers of meaningful relationships are involved. It has been shown in the present study that the same concepts are necessary to explain adequately those forms of learning which involve material that does not lend itself easily to establishing meaningful relations. Thus these principles are applicable to all forms of learning, offer an adequate explanation for each, and do not conflict with any known datum.

On the other hand, assumptions which underlie a mechanistic theory of learning presume to explain how nervous tissue acts when something is learned. However, assumptions such as the reflex arc or any other which implies point-to-point correspondence in a specific stimulus-reaction

pattern have been shown to conflict with neurological data. Assumptions which imply that relatively permanent synaptic changes result from passage of neural impulses have been shown to be inapplicable to a theory of learning. Principles derived from such assumptions appear useless when applied to so-called simple forms of learning, rote learning, and become extremely complicated when applied to complex forms of behavior where continually changing purposes and goals must be taken into account. Thus, both since they do not offer satisfactory or simple explanations for any form of learning common to ordinary classroom situations and since they conflict with known data regarding the functioning of nervous tissue, mechanistic principles appear to be inadequate.

## D. Analysis of Contemporary Theories in Light of Available Data.

Three main approaches to the problem of developing a theory of learning are apparent in contemporary writing. (1) A proposal which suggests the use of principles of learning derived from each of the basic points of view. (2) A proposal which suggests the possibility of extending principles derived from realistic assumptions to explain any form of learning. (3) A proposal which suggests the possibility of explaining any form of learning on the basis of relativistic assumptions regarding learning.

Proposals of T. R. McConnell are taken to represent the first approach. Analysis of the positions of other contemporary writers shows predominance of this point of view among them. The work of McConnell, however, is the most extensive with respect to a specific attack upon the problem of reconciliation of conflicts among theories of learning.

McConnell bases his recommendations primarily upon analysis of apparent similarities among three different points of view: (a) conditioning psychology, (b) connectionism, and (c) field theory. He attempts to show how contemporary connectionism and conditioning can be interpreted so as to harmonize with field theory. McConnell hardly recognizes the basic difference between realism and relativism in psychology, traditional source of conflict in this field. This difference is basically the assumption or non-assumption that behavior is determined by a condition of the synapses.

With respect to this difference, McConnell apparently follows the position of Gates who states that an assumption of specific neural connections is not required by contemporary connectionism. Other writers claim the same for conditioning. However, an analysis of Thorndike's recent writings shows that he still bases his learning theory upon traditional realistic assumptions. His

principle of belongingness, taken by McConnell and Gates to be similar to principles of field theory, is based upon the hypothesis that "belonging is the consequence of direct continuity of conduction."[37] Thus belongingness is considered by Thorndike as basically dependent upon a condition of the synapses.

Since this difference still exists between contemporary psychological realism (as represented by Thorndike) and psychological relativism, it appears that the similarities upon which McConnell bases his proposals for reconciliation are superficial. If one traces the assumptions which underlie the points of apparent similarity, the systems are directly and unalterably opposed. For this reason McConnell's proposals are unlikely to achieve the degree of harmony which he anticipates.

McConnell assumes that conditioning principles have limited but necessary application in a classroom. He assumes that they are necessary to attain precision in skills, for rote learning, and for similar activities. He suggests application of development-of-insight principles for situations which require meaningful learning. He believes that the practical consequences of assigning two sets of principles to divisions on a continuum of learning activities will not lead to important conflicts.

37. E.L.Thorndike, "The Fundamentals of Learning," p. 76.

This approach to reconciliation is questionable when evaluated in accordance with the criteria proposed for the present study. McConnell does not take adequate cognizance of the basic assumptions which underlie contemporary realism in psychology. Our study indicates that none of the recent modifications in connectionism has removed the logical necessity of assuming that behavior is dependent upon a condition of the synapses. The use of principles derived from this pattern of thinking alongside principles derived from the opposite view is introducing inconsistencies which will inevitably produce recurrent conflicts in ordinary classroom situations. For these reasons, the first proposal considered in this study is regarded as an inadequate approach to a theory of learning.

Proposals of Clark L. Hull are taken by the writer as representing the second approach to the present problem. He has written one of the most recent books on conditioning theory. He presents his theories as an attempt to reconcile conflicts among learning theories, and analysis of his position shows that his attempt is to apply conditioning principles to all phases of learning.

Hull's law of reinforcement is his primary law of learning. This states, in effect, that learning is dependent upon repeated passage of neural impulses over specific neural pathways. Hull attempts to expand this

principle to account for behavior which is dependent upon complex patterns of stimuli or which results in complex reaction patterns. He applies the principle also to purposive behavior and cites as an illustration the neural phenomena involved when a person learns to differentiate between a red traffic light and other red lights, and to behave accordingly.

However, in all instances Hull applies his principle of reinforcement as a necessary requisite for learning. If this principle is required for adaptive behavior, then it can not explain how an individual can react correctly the first time he is confronted with a new situation. Without opportunity for a period of reinforcing trials, a correct reaction the first time would be due purely to chance. This has been a long-standing criticism of realistic principles in psychology, but Hull has not dealt with the problem in his latest text.

Hull also apparently ignores data relative to the assumption of a close point-to-point correspondence between receptor and effector organs. This assumption is required by a realistic point of view, but data reviewed in the present study make the usefulness of such an assumption doubtful. Hull's position in this respect is inconsistent with data which are now available and are pertinent. For the foregoing reasons this second approach to a theory

of learning is found to be inadequate. Contemporary conditioning, as represented by Hull, does not explain learning phenomena adequately, and is inconsistent with data regarding the functioning of nervous tissue in learning situations.

The third proposal considered in the present study is the possible application of relativistic principles to explain all forms of learning. Data from experimental work presented by Katona and others indicate that a concept of learning as development of insight can be applied successfully to explain memorization of nonsense syllables and other forms of rote learning. It is indicated also that some type of organization on the part of the learner is required before any learning of this type of material can take place. This concept of learning does not conflict with theories of memory formulated by Bartlett and Rapaport on the basis of experimental evidence from a wide variety of remembering situations.

These conclusions are in opposition to those adopted by certain contemporary writers who assume that conditioning principles are required for rote learning. However, application of relativistic principles to the interpretation of data from Thorndike's own experiments yields more satisfactory and reasonable explanations than can be secured from opposing points of view. Thus, relativistic principles

appear to offer the most adequate explanation, even for learning phenomena which have traditionally been considered as requiring conditioning principles.

Relativism as applied to psychology makes no assumptions regarding the exact manner in which the nervous system works to insure learning. Data relative to this question indicate that an organism functions predominantly as a whole rather than on the basis of specific one-to-one connections between receptor and effector organs. Principles of learning as development of insight stress the relational aspects within psychological fields rather than requiring analyses of parts. In this respect psychological relativism follows the same pattern of thinking as that which appears more adequately to explain the whole-part relationship of the nervous system.

On the basis of these considerations an application of relativistic principles to a theory of learning appears to be advisable. These principles have been shown to be applicable to learning material wherein establishment of meaningful relationships is difficult. These principles conflict with no available data. The concept of learning as a sensing of relationships offers an understandable and adequate interpretation, on the basis of which a teacher can cope successfully with any learning situation.

# CHAPTER VII

## SOCIAL IMPLICATIONS OF OPPOSITE THEORIES OF LEARNING

Education in a democratic form of society is generally recognized as having for a primary objective the development of citizens who are capable of intelligent action based upon independent thinking. The success with which an educational institution within a democracy attains this objective depends in a large measure upon how closely the various plans of action which govern all phases of the life of a school harmonize with democratic principles. The relation of an absolutistic philosophy to authoritarianism has been pointed out by Hopkins.[1] He shows that conditioning principles imply an assumption that subject matter is fixed-in-advance material which is to be learned for its own sake. He suggests that conditioning principles are more consistent with an authoritarian philosophy than with a democratic one since they are part of an absolutistic pattern of thinking.

Tieleman also has shown the relationship between realism, as represented by Thorndike, and authoritarian practice. He summarizes his analysis as follows:

1. L. T. Hopkins, Interaction: The Democratic Process, p. 133, ff.

> Thorndike reflects his absolutistic bias markedly in his analysis of human nature. He assumes that human nature can be disclosed by reducing the individual into his constituent parts or elements, as though these parts or elements have independent and fixed meanings. Consequently, he describes human nature as an accumulation of stimulus-response bonds and elemental wants or drives. We observe, further, that the human elements (bonds and wants) are regarded as being sensitive to specific elements constituting the situation. Thus, particular, independent, or fixed elements of a situation are presumed to evoke specific modes of conduct. Personal interpretation of a situation in the light of accumulated and reorganized experience is ruled out. Moreover, the individual is regarded as passive to the elements of the situation into which he has been placed by chance.... In other words, realism, as represented by Thorndike, is absolutistic, and as such does not allow for individual freedom of choice. It is logical to presume that any educational program based upon this philosophy will not provide for reflection upon consequences, for such a program would be deemed "unrealistic" and "psychologically unsound" or inexpedient.[2]

The fact that contemporary theories of learning, for the most part, include conditioning principles makes them, to this degree, inconsistent with democratic philosophy.

The theory of learning which a democratic educational organization adopts must not only be consistent with

2. Adrian Tieleman, "Democratic Implications of Realism in Human Dynamics and Education," Unpublished Doctor's Dissertation, University of Kansas, 1945, pp. 170-171.

democratic philosophy but also should be conducive to the development of independent learners. E. E. Bayles points out this requirement when he writes,

> Life is continually changing; ideas which are adequate today are likely to become inadequate tomorrow. Therefore if a pupil is to be taught in such a way as to enable him progressively and continually to reconstruct his own outlook on life, even after he leaves school and may no longer call upon his teachers, he must be taught how to learn by and for himself. He must become an independent learner. Education for democracy requires such teaching, because citizens in a democracy are each and all responsible for passing judgment upon matters which make for a democratic way of life. Each new day evokes new problems and calls for new judgments. Only to a very limited degree can schoolroom instruction of today anticipate the solutions to tomorrow's problems.[3]

A theory of learning based upon mechanical repetitions of material is not conducive to the development of independent learners. The nature of the process is not likely to promote an attitude of open and free inquiry, an attitude essential to training students to learn for themselves. The inverse relationship between the degree to which contemporary theories of learning are based upon principles of conditioning psychology and the degree to which they are

3. E. E. Bayles, "The Relativity Principles as Applied to Teaching," University of Kansas Bulletin of Education, p. 7.

conducive to the development of independent learners can be illustrated by reference to two of the contemporary texts which have already been reviewed in the present study.

Risk, as noted, places considerable emphasis upon the use of conditioning principles in classroom situations. In the section of his text, wherein he discusses methods of handling pupil questions and answers, he mentions the problem of free and open inquiry in the classroom. His attitude is as follows:

> While pupils are to be encouraged to ask questions freely, the teacher should insist that the pupils be courteous in asking questions whether of the teacher or of classmates. All class work should be held up to the proper standard in this respect. The training should fit for any social situation in life. Pupils should be required to be courteous because they ought to be, and courtesy should be considered a matter of course in carrying on classwork.
>
> The pupils should be allowed to question the authority of a statement, and the teacher should use patience and tact in dealing with such problems. Pupils must be made to feel that all questions should be settled on the basis of fact and that the teacher is just as interested in the truth as they are. It may be a good lesson to show them that authorities frequently disagree and that one may be as good as another. In some matters it is allowable to tell pupils that they are entitled to their opinion, but in others they may be told that certain facts will be considered the acceptable answer to the question. Members of a class should not be allowed to carry on a dispute over the facts. If the matter is important

> enough, the facts of both sides may be definitely stated by the proponents, and the merits evaluated by the class. Pupils should betaught that questions must be dealt with on the basis of reason and logic, supported by acceptable evidence.[4].

The reluctance with which Risk accepts the use of controversial issues as part of the course of study indicates that he is not seriously intending to train independent learners. For the most part, the pupils in classroom which he describes will be engaged in determining facts -- fixed, indisputable knowledge. He adopts this attitude consistently, as indicated by the following excerpts:

> The problem teaching procedure contemplates, to be sure, proper supervision of the efforts of pupils in arriving at satisfactory solutions.[5].

> The teacher should give appreciative consideration to all pupil responses. Pupils should be made to feel that their contributions are worth while and that they will be given consideration even though they may not always be exactly correct or just what the teacher wants.[6]

> At times it is desirable to get the class to evaluate pupil answers. This has several advantages. It makes the class more attentive and critical of the points being presented, since they in turn may be called upon. It serves as a test of real thinking and understanding.[7].

4. Thomas M. Risk, Principles and Practices of Teaching in Secondary Schools, p. 529.
5. Ibid, p. 452.
6. Ibid, p. 530.
7. Ibid, p. 531.

Risk does not indicate specifically what he means by the use of the words "satisfactory solutions," but it is clear from an appraisal of his text as a whole that he advocates an absolutistic approach. He expects the acceptable solutions to conform to pre-determined answers. If he accepts his own statement that class evaluation of answers serves as a test of real thinking and understanding, it seems strange that he suggests only occasional use of such procedures. He is apparently more concerned with the use of this type of pupil participation as a device to secure attentiveness -- a disciplinary measure -- than he is with the development of independent learners.

The position taken by Risk with respect to free and open inquiry in the classroom is consistent with the basic philosophy which underlies a mechanistic theory of learning. The fact that he adopts conditioning principles for many classroom learning situations has a definite relationship to attitudes which he adopts in other areas of thinking. If pupils are to be trained merely to reproduce the habits and customs of the social group to which they belong, then a mechanistic theory of learning might be adequate. If pupils are to be trained thus, then there need be no concern about their ability to do independent thinking. Satisfactory solutions become those which society has already labelled as "good," either because of some assumed inherent goodness

or because everyone "does it that way." This way of thinking implies a static society -- a condition which democracy is designed to avoid.

Burton also, in a discussion of the problem of "verbalisms" as related to learning, adopts an attitude which suggests a philosophy of fixed-in-advance knowledge. (It has already been pointed out that Burton disavows adherence to an absolutistic philosophy and that his suggested use of conditioning principles in classroom learning situations is more limited than was found in Risk's text.) Burton[8] cites an incident which occured in a high school. In competition for a prize offered by civic groups, a high school student submitted an essay setting forth the ideals, duties, and functions of a good citizen. The essay was widely distributed and the pupil was regarded as having learned the basic requirements of good citizenship. A few months after graduation from high school this same boy was caught planting a bomb in the office of the town's newspaper. Investigation revealed that the boy had been associating with young hoodlums and bootleggers for some time, and that he had actually been selling narcotics to high-school students at the time he wrote the prize winning essay.

8. William H. Burton, The Guidance of Learning Activities, p. 43, ff.

Burton uses this as an illustration of misconceptions regarding learning, specifically that "facts and verbalisms are accepted as satisfactory outcomes when certain abilities, habits, or skills are the necessary outcomes."[9]. His criticism of the acceptance of verbalisms as evidence of learning is warranted, but his analysis indicates that he merely substitutes one set of fixed-in-advance habits for another. He writes,

> The first reaction is to say that the boy had not really learned anything about citizenship. Not quite. He had unquestionably learned -- but not the appropiate learnings. He had learned the proper words to say in response to given situations. He had learned verbalisms about citizenship. He had not learned the understandings, attitudes, abilities, and patterns of behavior which make up citizenship in action. The trouble was not that he had not learned, but that he had learned the wrong kind of response for the life situation.[10].

Several paragraphs later, he refers to the example again.

> In the case of the "Civic Code" cited above, the school supplied ample intellectual learning, assuming that this would control emotional or moral situations. The school completely neglected the specific attitudes, the definite mechanisms, the general and specific habits and patterns of action which make up citizenship. To know what is right is one thing. To wish to do right and to possess the habits of right conduct are two quite different things.[11].

9. Ibid, p. 42.
10. Ibid, p. 43.
11. Ibid, p. 44.

What Burton means by "definite mechanisms" and "general and specific habits" which make up citizenship is not clear, but he implies the substitution of one set of habits for another. Training for the new set need not be fundamentally different from that which produced the undesirable ones. The theory of learning, at least, need not be changed since a mechanistic theory assumes that good habits can be substituted for bad ones by a stamping-in process.

The foregoing is not intended to imply that classroom teaching for intelligent action in a democracy can be accomplished merely by changing from one theory of learning to another. It can be stated, however, that a mechanistic theory of learning does not lend itself to a democratic pattern of thinking as applied to classroom techniques. Conditioning principles imply existence of fixed-in-advance curricular units. As Tieleman has stated, this type of training "does not allow for individual freedom of choice."[12] If any knowledge is fixed in advance, the learner must accept it as such; he has no choice. Such an attitude is evident in the quotations from Risk. It is epitomized in his statement that "members of a class should not be allowed to carry on a dispute over facts."[13].

12. Adrian Tieleman, op. dt., p. 171.
13. Thomas M. Risk, op. cit., p. 529.

In Burton's illustration, the patterns of action which result in good citizenship are assumed to have been fixed in advance. There is no provision, indicated in his statements at this point, for permitting the pupil to exercise choice in determining acceptable patterns of action. If one assumes that patterns of action are, in part, definite mechanisms, then one is logically bound to use conditioning principles of learning to develop these mechanisms. The reverse is also true. If one assumes that conditioning principles are necessary in learning, then one is logically bound to assume the existence of fixed-in-advance realities whether they be patterns of action, scientific laws, or elements of matter. This logical relationship makes the choice of a theory of learning an important one. Adoption of such a theory either requires or is determined by the prior assumption of fixed-in-advance knowledge.

There are social customs which change slowly, and many accepted patterns of action have not varied greatly from one generation to another. But the implications of an assumption of fixed-in-advance knowledge make it inadequate for our present conception of society. Even though certain customs may change little from generation to generation, they should be continually subject and subjected to democratic scrutiny, in the light of changes elsewhere. The apparent stability shown by certain areas of knowledge or

by certain social customs tends to make an assumption of fixed ends plausible. Such an assumption, however, implies a static society which, it is also assumed, has probably achieved perfection in the apparently stable areas of knowledge and which is expected to achieve perfection in other areas in the not too distant future.

Dewey speaks of these two views -- a static society versus a changing society -- in relation to the purposes of education. He says,

> For purposes of simplification we have spoken in the earlier chapters somewhat as if education of the immature which fills them with the spirit of the social group to which they belong, were a sort of catching up of the child with the aptitudes and resources of the adult group. In static societies, societies which make the maintenance of established custom their measure of value, this conception applies in the main. But not in progressive communities. They endeavor to shape the experiences of the young so that instead of reproducing current habits, better habits shall be formed, and thus the future adult society be an improvement on their own.[14].

> The account of education given in our earlier chapters virtually anticipated the results reached in a discussion of the purport of education in a democratic community. For it assumed that the aim of education is to enable individuals to continue their education -- or that the object and reward of learning is continued capacity for growth.[15].

14. John Dewey, Democracy and Education, p. 92.
15. Ibid, p. 117.

If education is to enable society to improve progressively some provision must be made to train members of society to cope successfully with changing conditions rather than train them in the habits of the past or present. A mechanistic theory of learning not only does not lend itself to such philosophy, but actually thwarts the attainment of objectives such as those presented by Dewey.

Luchins' study on mechanization in problem solving (referred to in the previous chapter) gives some evidence of the effect which a conditioned-response theory of learning may have upon public school children. It was this group of subjects which had more difficulty than any other in shifting from a practiced method to a more direct method when a new problem was presented. Luchins[16] analyzes the data and offers the hypothesis that the children repeated the same method in all problems because they thought that the experiment was a test, or that it was a lesson in arithmetic, and carried over to it attitudes developed by the methods of teaching employed in the schools.

Luchins points out that the three public schools cooperating in the experiment did not all employ similar teaching methods. Two used traditional drill methods, for the most part; the third used a modified form of activity

16. Abraham Luchins, "Mechanization in Problem Solving," Psychological Monographs, 1942, p. 18.

program, except in tool subjects where drill was given if results of achievement test scores indicated weakness. A private elementary school, also participating in the experiment, employed an activity program in which certain children were given special drill in fundamentals. With reference to the comparisons which he makes, Luchins writes,

> In order to determine whether progressive methods of teaching favor less E-Effect it is necessary to have two schools that are equated for all personal and social factors but differ in the methods of teaching -- one using "drill methods" and the other some of the modern "activity methods."[17]

Since the experiment reported was not intended to compare two methods of teaching, the data are insufficient to permit final conclusions to be based on such comparison. Luchins believes, however, that some differences were indicated. He says,

> ... Offhand, however, it would seem from this comparison and from rough analysis of the variation of E results with teaching methods employed by individual teachers in the same school, that progressive pedagogical procedures are conducive to smaller E-Effects. This conclusion should be taken as an hypothesis which is suggested by some aspects of the results of the present study. ...[18]

17. Ibid, p. 21.
18. Ibid, p. 22.

Luchins discusses the educational implications of the data as follows:

> 1. In most of the public classes in which this experiment was conducted, the teacher, after introducing a new procedure, rule, or formula, gives a series of assigned tasks. The pupils practice the just taught method in quite a number of cases. Exact and accurate reproduction (application) of what the teacher taught is the aim.
>
> 2. Many of our subjects, both in the college and in the elementary schools, because of their school training viewed arithmetic as composed of a heterogeneous manifold of definite facts and operations, of fixed habits and skills; one must always try to remember the particular rule, formula, or method which works in any given type of arithmetical problem. ...
>
> 4a. In some classes the relationship of the children to the teacher seemed to be that of followers of a master....
>
> Such relationship may focus the child on guessing "what teacher wants," instead of examining freely the task at hand to see what solution it requires. The child tries to guess and do just what teacher wants done in the problem. ...[19]

Development of such an attitude is not entirely due to the use of conditioning principles in classroom learning situations. It is probably dependent, instead, upon the entire pattern of thinking which the teacher may follow; thinking which is often in keeping with acceptance of an absolutistic theory of learning. It is likely, however,

19. Ibid, pp. 90-91.

that even in schools which attempt to provide opportunities for pupils to face freely the requirements of a situation, the training received from such experiences may be lost if teaching procedures derived from principles of conditioning are introduced at any point whether for the purpose of memorization or for attainment of precision in a skill.

Social implications of theories of learning should receive more consideration than has been given thus far in our educational practices. If a set of ready-made solutions would be adequate for all or even most of the problems which confront an individual, then principles of learning which transmit these solutions quickly, exactly, and easily should be adopted. Under such conditions, to allow pupils to interject their own ideas and suggestions would be a waste of time since most of their ideas would deviate from the correct solution.

But such a conception of fixed-in-advance solutions to problems which confront a people is not in keeping with democratic principles. Social customs, habits, and ways of doing things which have remained unchanged for a considerable length of time should be continually subject to reappraisal. Pupils should determine for themselves whether these apparently fixed solutions are adequate and consistent with conditions of the present. Even when their solution to a given problem coincides with that accepted by society

they will have a more intelligent understanding of the problem than if the solution had been presented to them, prior to the learning activity, as the one which they would eventually find if they solved the problem correctly.

Not only will pupils develop an adequate understanding of relatively fixed solutions when they study the process by which these solutions were determined, but also they will gain insight into the methods of handling new problems. This is of primary importance in our society, since genuine problems always call for new thought. Real participation in the process of formulating principles by which one guides one's behavior precludes authoritarian control of the results. A theory of learning which stresses the sensing of relationships rather then the acquirement of fixed habits is best adapted to the requirements of a democratic society.

## SUMMARY AND CONCLUSIONS

Confusion is evident in certain contemporary texts on teaching with regard to the theory of learning which shall be employed. Thoughtful consideration of data relevant to this problem is essential for attainment of professional competence. An evaluative study of contemporary texts is undertaken by the writer to determine the nature of the

proposals submitted, and to suggest the best approach to the problem. The criteria for evaluation are those of adequacy and consistency. A theory of learning is adequate if it takes into account all pertinent and available data and consistent if it does not conflict with the data or with valid conclusions reached in related fields of human thought and concern.

Historical conflicts in psychology stem from two basically opposing points of view in psychology. One view -- absolutistic -- is based upon an assumption of the existence of ultimate reality within the realm of mind or matter. Exact knowledge of these assumed ultimates becomes of primary importance. The opposite view -- relativistic -- is based upon the assumption that everything is in a continual state of flux. Efforts to establish a working relationship among the continually changing features of environment become of primary importance.

Application of an absolutistic view in psychology has resulted in the development of several different "schools." Faculty psychology is based upon the assumption that ultimate reality resides in mind. Association psychology is based upon the assumption that ultimate reality resides in matter. The latter is the forerunner of other theories which can be grouped in three relatively distinct divisions: (a)

behaviorism, as represented by Watson, (b) conditioning psychology, as represented by Pavlov, and (c) connectionism, as represented by Thorndike.

Application of relativistic principles to psychology is a comparatively recent development. Organismic, Gestalt, configurational, and field theory represent variations of this view. Appearance of this new approach has produced many conflicts in the field of psychology.

With regard to a theory of learning, the basic issue between these opposing points of view centers around the assumption or non-assumption that behavior is dependent upon a condition of the synapses. A realist in psychology assumes that each stimulation combined with a response increases the probability that a subsequent presentation of the same stimulus will evoke the same response. It follows that there will be a continuous strengthening of a connection as a function of the number of times that the stimulus-response sequence has occurred. A relativist in psychology assumes that learning is not a continuously cumulative process dependent primarily upon successive repetitions. He assumes instead that learning occurs only when an organism is confronted with a situation in which it can not immediately perceive a relationship of the elements within the situation which will enable it to progress toward

its goals. Learning consists in reorganization of insight into the elements within a situation in accordance with the purposes and goals of the organism.

Contemporary proposals for possible reconciliation of differences among theories of learning are considered in the present study. McConnell suggests the use of principles of learning derived from different points of view. This proposal is shown to be inadequate since the different views from which he derives his principles imply opposing assumptions and therefore a classroom teacher would be continually confronted with conflicting procedures. Hull suggests extension of conditioning principles to cover all forms of learning. His proposal is shown to be unsatisfactory, since his formulations are too complicated for the ordinary classroom teacher; since his principles do not adequately explain all forms of learning; and, since the basic assumptions required are inconsistent with available data regarding the functioning of the nervous system. Katona and others suggest the use of relativistic principles for the development of a theory of learning -- a theory which is also consistent with data from Bartlett's and Rapaport's analyses of theories of remembering.

It has been shown that these principles offer a more adequate explanation for even those phases of learning which have been considered as requiring conditioning

principles. Within the limits of the data available for the present study, the proposal that learning should be regarded as the development of insight appears to be more consistent than either of the other two, and equally adequate if not more so.

Not only does the conception of learning as development of insight explain all phenomena related to learning more harmoniously than the opposing conceptions, but also it is more in keeping with the ideals and requirements of a democratic society. Absolutistic principles, with a philosophy of fixed-in-advance knowledge, imply authoritarian control of learning situations; relativistic principles, with a philosophy of knowledge as consisting of a continually changing set of hypotheses and principles by which one attempts to guide his actions, has no need for authoritarian control and are therefore more adaptable to democratic concepts. Absolutistic principles also imply use of a mechanical procedure to develop pre-established patterns of conduct; relativistic principles imply continual reconstruction of working relationships among all phases of environment and are therefore more adaptable to the development of independent learners.

On the basis of the present study, available data indicate that application of relativistic principles offers the best approach, at the present time, to the problem of

developing a theory of learning. This approach offers an understandable hypothesis which is consistent with relevant data and with which one can attack problems of learning in a classroom with reasonable chance of success. It is adaptable also to the framework of a democratic society whose preservation is dependent upon the development of citizens who are capable of progressively intelligent action.

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